

PC MAGAZINE

NETWORK
EDITION



◀ **FIRST LOOKS:** Get Stunning Color Output From Canon's New \$719 Ink Jet

Blazing Video!
New Chips Drive Windows Graphics To New Heights

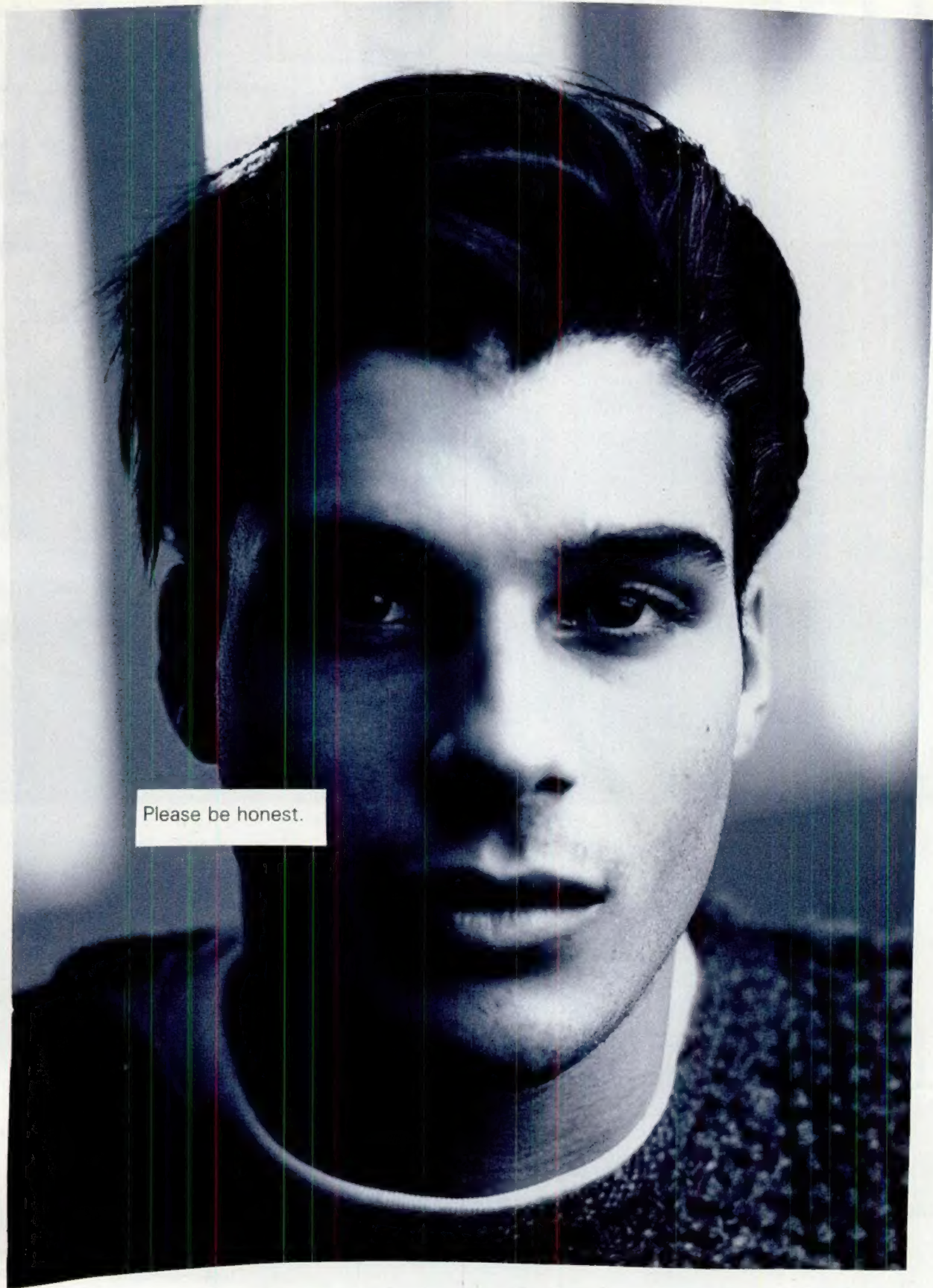
Network Management:
How Integrated And Effective Are Today's Packages?

THE 486 PC Labs Tests **191** of the BUYERS' Fastest PCs Money Can Buy GUIDE





Don't lie to me.



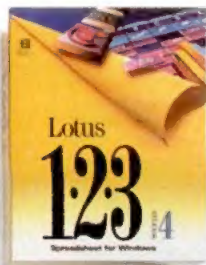
Please be honest.

CIRCLE 157 ON READER SERVICE CARD

THE ME GENERA THE WE SPR



1-2-3 RELEASE 4 BRINGS IT ALL TOGETHER.



Once again,
the world of
spreadsheet
users is coming
together around
Lotus® 1-2-3.®

The new 1-2-3 Release 4 for
Windows™ has made using a spread-
sheet easier, faster and dramatically
more productive for everyone, based on

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Microsoft® Excel users surveyed would
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workgroup capabilities are not only
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spreadsheets, they're improving the

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worksheet data...will find
Release 4 indispensable.”
PC/WEEK, 5/3/93

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Windows applications are mail-enabled, you can quickly and easily share your data with others on the network. And vice versa.

COLLABORATE ON A HIGHER PLANE.

The real power of Working Together comes from 1-2-3's advanced Versioning technology and group editing powers.

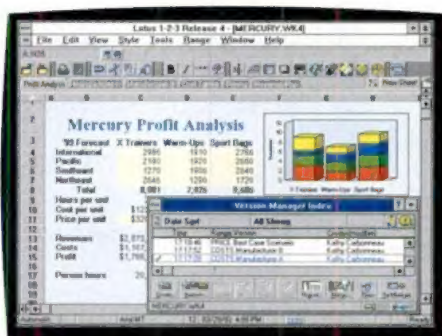
These are features no competitor can match.

With Version Manager™ technology, workgroup members know who made what contributions to a file, when and why. Each group member can save, label, track, mix, merge and comment on ranges, worksheets or entire files. And do it all without overwriting existing data or making multiple copies of the same file. Now we're sharing ideas, not merely sending spreadsheets.

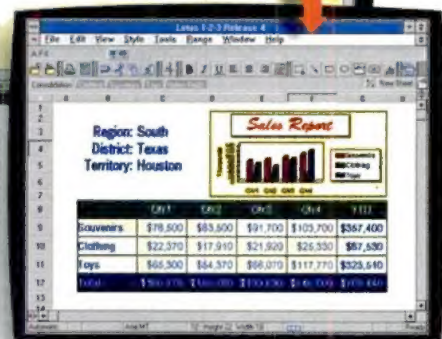
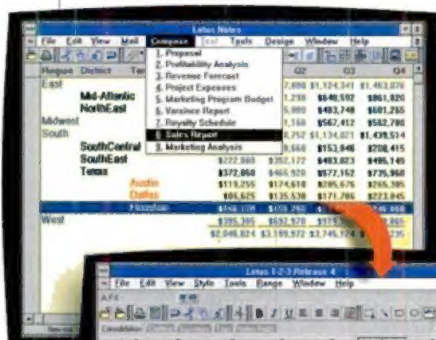
All this can be done over LANS, e-mail or even diskettes for that matter.

RAISE YOUR GROUP CONSCIOUSNESS.

Working Together with 1-2-3 can be



Version Manager lets each member of your workgroup know who made what changes to a file, when and why.



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further enhanced with Lotus Notes®, the market-leading groupware. Notes allows different users to access, track and share work on the same spreadsheet at the same time, with the

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P21

CIRCLE 026 ON READER SERVICE CARD

Inside

In what has become an annual ritual, this issue appears as we prepare to trek to Fall Comdex in Las Vegas, the computer industry's annual rite of self-affirmation. It is also at this time of the year that we

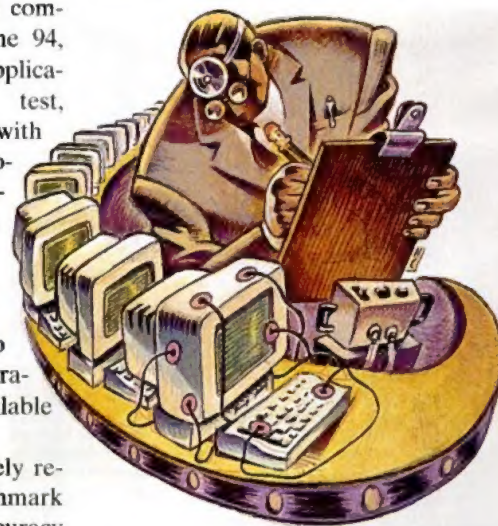
update our PC Magazine Labs benchmark tests. Just as Comdex defines the state of the industry, our benchmark tests define the core of what we do: comprehensive, labs-based, comparative testing.

The massive review of 191 PCs in this issue ("The 486 Buyers' Guide") introduces a completely new test: Winstone 94, Version 1.0. Our first applications-based benchmark test, Winstone was developed with the cooperation of Microsoft. It's the most comprehensive set of test routines ever devised for Windows performance. Because we use the actual applications in our code, Winstone is too large to be distributed by traditional means. It is available only on CD-ROM.

We have also completely revised our PC Labs benchmark tests to improve their accuracy and effectiveness in measuring the performance of today's more complex machines. PC Bench 8.0 and WinBench 4.0, like their predecessors, will continue to measure DOS and Windows performance and will be distributed on floppy disk and electronically via ZiffNet. For details on how they work and what they measure, see Lab Notes in this issue.

These new benchmark tests

are the result of close collaboration among far-flung units of Ziff-Davis, our publisher. Last year, Bill Machrone (Ziff-Davis's vice president of technology), Jim Galley (director of PC Labs), Nick Stam (our technical



director for hardware), Edward Henning (director of PC Labs UK), and Bob Kane (director of ZD Labs) began working with the staff of the Ziff-Davis Benchmark Operation, based in North Carolina. Thousands of e-mail messages and dozens of airplane rides have gone into delivering these benchmarks. The fruit of this collaboration is a technical triumph.—Joel Dreyfuss

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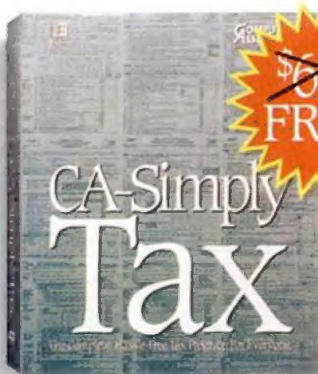
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CIRCLE 348 ON READER SERVICE CARD



New Paradox makes your desk a ramp on the data superhighway

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Version 4.5

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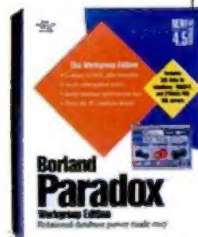
Of course, no new version of Paradox would be complete without enhancements to the powerful and easy-to-use features that have made it the #1-rated Windows database. Built-in productivity Experts™ guide you at every step, from linking tables to building forms and reports. Object Inspector™ menus provide instant access to capabilities without searching through layers of menus. Paradox's ease of use stays with you as you move up the power curve. Corporate developers find that ObjectPAL,™ the fully integrated

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Computers

486 Buyers'
Guide

BY JIM SEYMOUR So many PCs, so little time. Using a new generation of benchmark tests, *PC Magazine* tests 89 lines of computers in its 486 Buyers' Guide to see which are most likely to fit your needs108



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Pumping Pixels

BY JOHN R. QUAIN Mainstream video demands are rising as Windows users work with more sophisticated graphical applications and larger monitors. Using the new WinBench and Winstone benchmark tests, *PC Magazine* tests 43 new 2MB graphics accelerator cards that raise the bar on Windows video performance251

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Network Management: Behind the Scenes

BY FRANK J. DERFLER, JR. Network management packages can act as a LAN administrator's eyes and ears, enhancing the basic tools provided by the NOS. *PC Magazine* looks at the integration of utilities—both standalone packages and suites of products. How well do they gather and share information about a network's inventory, resources, and trouble spots?335

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A new generation of graphics chips drives these three boards to Editors' Choice status in our roundup of 2MB video boards (page 251).

NETWORK EDITION

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Print Servers: Multiprotocol Printing

BY TONY POMPILI Don't buy separate printers for your PCs, Macs, and Unix systems. Instead, buy a multiprotocol print server and save money and space.....NE1

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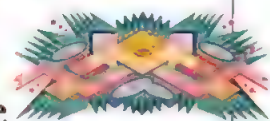
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AFTER WORDS

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Holiday Gift Guide



It's that time of year again: time to hit the stores to find the perfect holiday gift. But where to begin? This year, give the gift that fits; we've assembled 50 products to make your shopping easier.

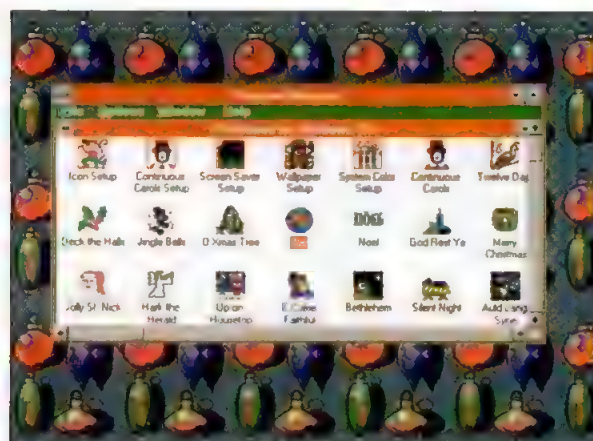
- Puzzles to Pinball
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BY DON WILLMOTT590

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Happy holidays! 50 great gifts, from screen tinsel to reference libraries (page 584).

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With Microtek's 3-pass scanning, image assembly is required.

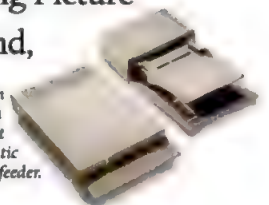
Microtek ScanMaker II



Microtek's 3-pass process, as represented here, must scan your image three times, then assemble and align all three scans into one. (Images shown are not final output.)

everything you need to be a scanning expert right out of the box, including Picture Publisher 4.0 LE, one of the most versatile image editing programs around, as well as TextBridge OCR software. For a free booklet on scanning, or to learn more about the easy-to-use ActionScanning System, or our other scanners for PCs and Macintosh, or our full line of personal printers, call the Epson Connection at **1-800-BUY-EPSON** (800-289-3776). This is one scanner you should jump at the chance to own.

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Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25e's.

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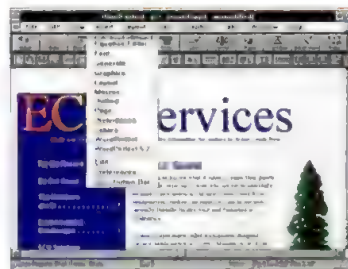
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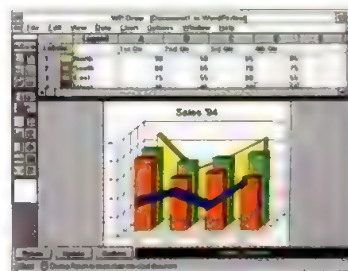
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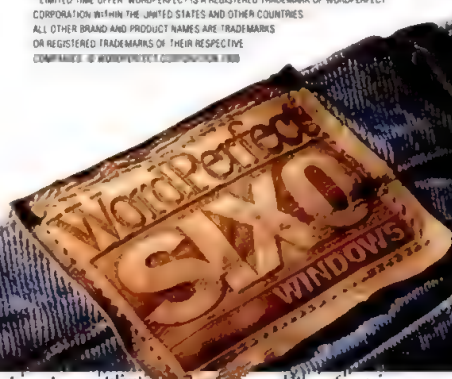


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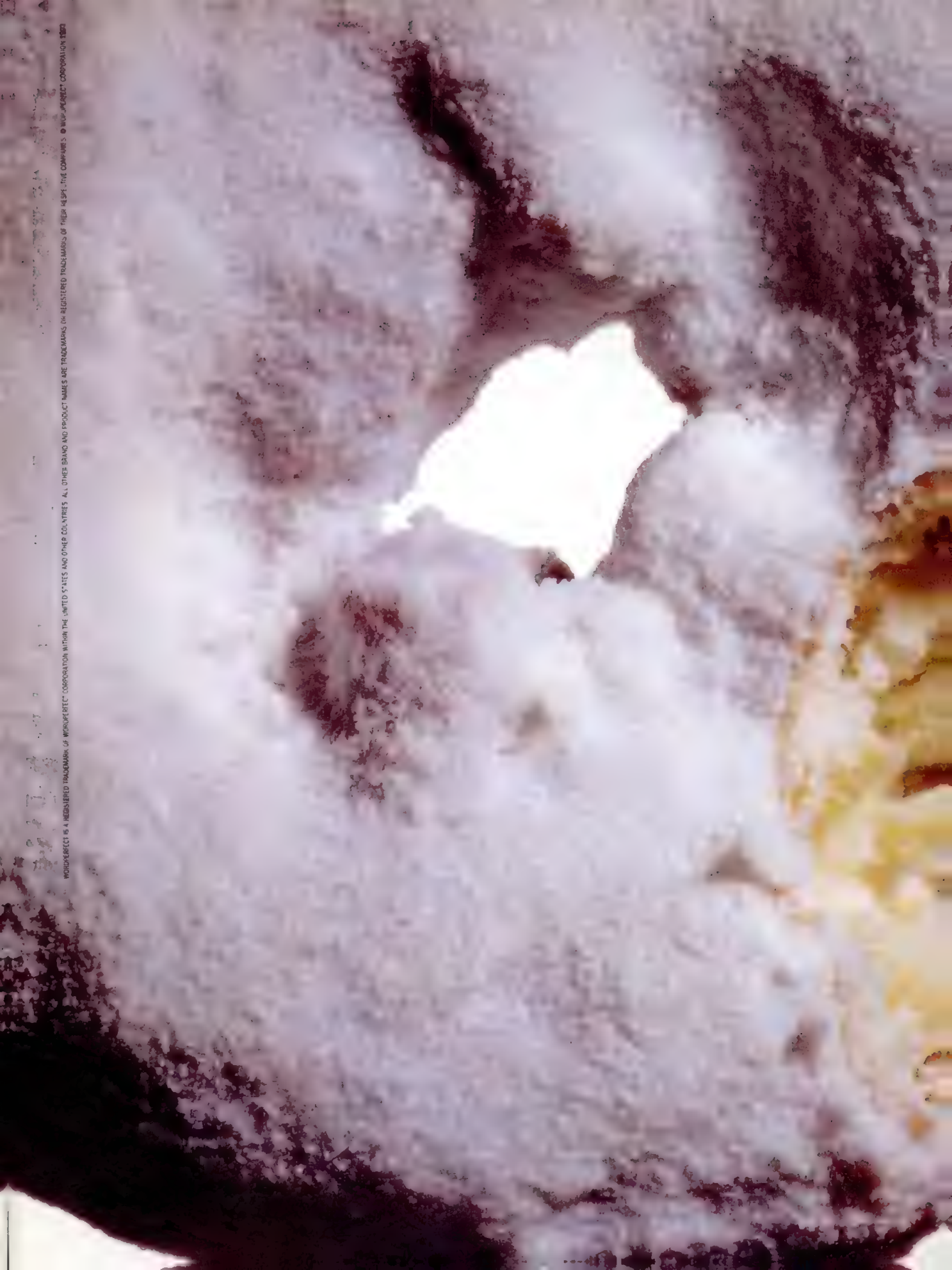
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For further information, contact the author at maria.garcia@univie.ac.at.
 Maria Garcia, PhD, is an assistant professor at the University of Vienna, Austria.

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Letters

DEMANDS OF IMAGE EDITING

I enjoyed your October 12, 1993 piece, "Has the Mac Met Its Match?," in which you reviewed image-editing software. However, I think you failed to adequately warn readers of the demands that image-editing programs place on hardware.

Although the benchmark tests that accompany the article explain that you tested the software on two fast 486 DX2/66s—one with 16MB of RAM and the other with 64MB—the introduction leads readers to believe that these programs may easily be used on a \$1,500 386/33 with 4MB of RAM.

What the introduction doesn't mention is that you can use such a system only if you enjoy long naps while waiting for redraws and if you don't mind losing data in frequent system crashes. Anyone who rushes out to buy Adobe Photoshop to run on two-year-old hardware is in for a big disappointment.

The average user will have to double or quadruple his or her PC investment to do any serious image editing. With each revision of a graphics program, the developer piles on more features until the sports car you were driving yesterday feels like an old overloaded pickup going up a hill on a hot afternoon.

Will Emerson
Laytonville, California

THE REAL VALUE OF CONFIGURATIONS

I am writing to express concern over the recent changes in the configurations *PC Magazine* is requesting for evaluation. In particular, I am referring to the minimum hard disk size (340MB) and RAM (16MB) required on the low-cost value systems sent in at your request for this issue's PC roundup ("486 Buyer's Guide"). These systems, including our own HP Vectra VL series, have been designed to meet the needs of individual users by providing a cost-effective yet highly functional PC. These systems are meant for use as client PCs, not for running networks.

We are concerned that the minimum requirements *PC Magazine* has set are



Users will have to double or quadruple their PC investment to do serious image editing.

raising both the costs and the capabilities of the systems reviewed beyond that which we feel is necessary for systems of this type.

Chris Morgan
Marketing Communications Manager
Hewlett-Packard Co.
Sunnyvale, California

• We specify a range of configurations based on the requirements of each test group. For instance, in our "Value-Line PCs: Family Values" (September 26, 1993) story, the configuration was for 8MB of system memory and a 170MB hard disk. The minimum configuration for future stories will continue to be based on the focus of the story.—Ed.

PARITY FOR AMERICAN PRODUCTS

In this day and age of fierce international economic warfare, I take great offense to anything that suggests American products are inferior. The opening paragraph of the "Value-Line PCs: Family Values" (September 28, 1993), story suggests that we should think about two Japanese cars when making comparisons. This is insulting to me and to all American workers.

Incidentally, later in that same issue a reference was made to Ford autos. The ref-

erence was derogatory, commenting that the cars are only available in black. In the foreign car reference, the words used included "fancy," "luxury," and "panache."

Joseph W. Fleming
Allison Park, Pennsylvania

MONITORING THE VALUE?

There is one glaring omission in your comparison of value-line PCs: There is no evaluation of the monitors that come with the systems! I would think that the primary interface between human and machine would deserve some consideration. As I have painfully found out, there is a wide variance in the quality of this important component of a PC.

Earle Greene
Perry, Florida

TESTAMENT TO BIBLE SOFTWARE

I greatly appreciated your review of religious software (After Hours, October 12, 1993). I particularly agreed with the kind accolades given to the Logos Bible Software 1.6, which you note as "the product against which other Christian software titles have been judged," although I must point out that the Logos program is basically a licensed Windows adaptation of the Freeware DOS 5 Online Bible program created by Larry Pierce. The Online Bible program offers most of the highly praised Logos features in a low-cost, free-ware format.

Maurice A. Robinson, Ph.D.
Wake Forest, North Carolina

As a Catholic priest and scripture scholar, I was equally pleased and disappointed to encounter the review of five scripture titles that appeared in After Hours, a section dedicated to "products for the leisure side of personal computing." I use my leisure time for playing games and reading computer magazines, yet I, along with countless numbers of priests, ministers, rabbis, theologians, and faithful, consider biblical research to be serious business that ought not be relegated to the leisure section of a magazine.

Still, the review illustrated the useful application of the personal computer, and

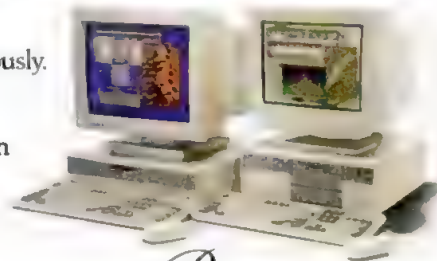
Of course, there are some things more exciting than waiting for graphics.

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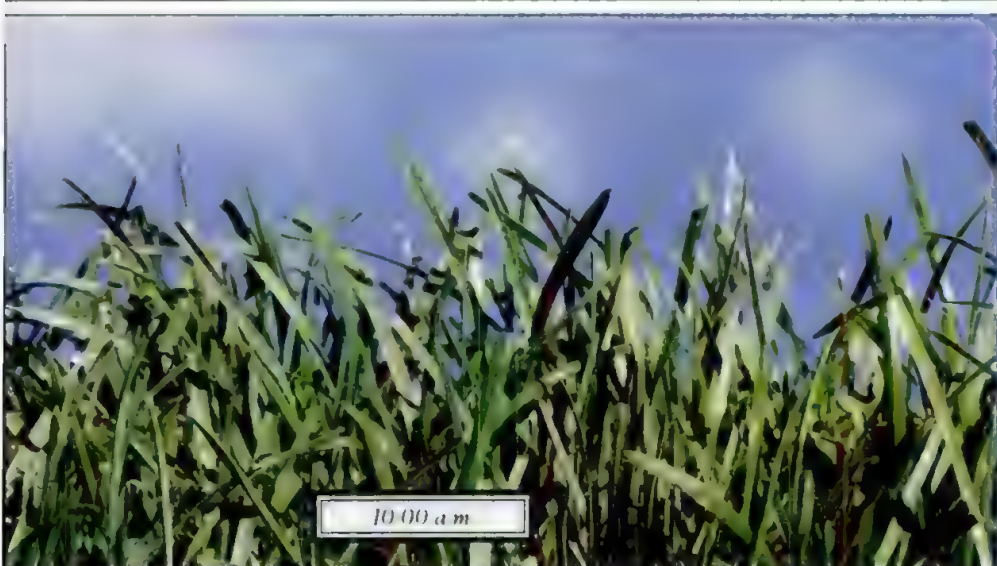
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LETTERS

I hope that more people will learn to use multimedia technology to access religious reference materials. Imagine the treasures of the Vatican's library and museums available to everyone.

*Fr. Robert H. Flock
Santa Cruz, Bolivia*

PROPRIETARY BOARDS

Regarding Bill Howard's column concerning repair and maintenance ("PC Vendor Out of Business?," September 28, 1993), a statement in the article may require some clarification for the computer-buying public.

The article reads, "Even if the motherboard is proprietary, you can replace it with a functional equivalent for \$250."

*My wife's employer sent her
to a two-day seminar
to learn Windows 3.0, and she
spent half that time
learning to play Solitaire!*

While the factual content is true enough, it doesn't prepare the consumer for the headaches that may ensue. When purchasing a system from Packard Bell, Digital, or any one of a number of manufacturers selling units with proprietary motherboards, buyers must be aware that they may be letting themselves in for a host of problems later on. In particular, if you want to upgrade your motherboard, you are locking yourself into one company, rather than expanding your choices to shop for a competitive price. Also, it isn't easy to purchase a motherboard from another manufacturer and install it in your desktop.

*Joe Lang
Union Gap, Washington*

MORE OPERATING SYSTEM BLUES

After reading Michael Miller's column, "Stuck Inside Those Windows Blues" (September 28, 1993), I have to concur. I'm blue and stuck, too. After seeing a flawless demo of OS/2, our small comput-

er-consulting firm upgraded its PCs to 486/33s with 16MB of RAM, running OS/2 in conjunction with a Novell 3.11 server. Well, I feel like a test pilot for an Apache helicopter. Field testing OS/2 is not fun. None of our "Maps" stick, DOS commands don't work, and after investing 60 hours into the deal we still can't get it to work as a productivity tool.

*Ron Berardinis
Cleveland, Ohio*

BASIC LIVES ON

Excellent! You have outdone yourselves once again with the article "Not So BASIC Anymore" (September 28, 1993). When it comes to BASIC programming, Microsoft could easily be a hands-down winner. Microsoft's product could invoke admiration, but a serious stumbling block is that it lacks several important elements, including bit operations, unsigned integers, in-line assembly, strings larger than 64K, text boxes larger than 32K(?), and 32-bit compilation. Microsoft seems to have a contradictory psychology that translates into a two-pronged reaction of admiration and hostility from users.

*Ion Saliu
Biglerville, Pennsylvania*

Thank you for the excellent article on BASIC. Now I would love to see the same kind of coverage of the C family of languages, C and C++, Visual and otherwise. But you probably have that in mind, anyway. *PC Magazine* is the most consistently informative computer magazine around.

*Herbert Gompertz
New York, New York*

It's nice to see some interest shown in BASIC again! Too few people realize the full extent of BASIC's capabilities, let alone the range of useful programs that can be written in BASIC.

*Brandon Carnahan
Phoenix, Arizona*

PLAYING WINDOWS' GAMES

I had to chuckle when I read Niels Nielson's comments about learning Windows (Letters, "Learning Windows," October 12, 1993). He stated that he spent half the course learning to doodle but "at least he didn't take time to learn how to play games." A couple of years ago, my wife's

employer sent her to a two-day seminar to learn Windows 3.0, and she spent half that time learning to play Solitaire!

*Austin Troxell
Simpsonville, South Carolina*

SCANNING WITH CORELDRAW

Jim Mathews's letter in the October 12, 1993 issue ("I Love CorelDRAW, But...") had me scratching my head. He criticizes your review of CorelDRAW 4 (First Looks, August 1993) for not mentioning that product's failure to support SCSI scanners through the Twain interface.

As far as I know, CorelDRAW can't support any scanners, and neither can any other vector graphics product I've ever used. Furthermore, CorelPhoto-Paint 4, which is included with CorelDRAW 4, can support scanners; I've used it hundreds of times with my Epson EPS 800C, which is device 3 on my UltraStor 34F bus-mastering SCSI-2 controller. Works fine every time.

*Donald M. Chaffee
Wellesley Hills, Massachusetts*

CORRECTIONS AND AMPLIFICATIONS

The September 28, 1993, article "Network Backup Evolves" said that Palindrome Corp.'s Network Archivist runs only in DOS under NetWare 3.x and 4.x. To clarify, in both cases the software resides as a NetWare Loadable Module. Network Archivist also supports multiserver backup and logs tape usage.

In the September 14, 1993, article "Disk Cache: Performance vs. Safety," we incorrectly reported the name of HyperWare's product. The correct name is HyperDisk Speed-Kit, not HyperDisk Speed.

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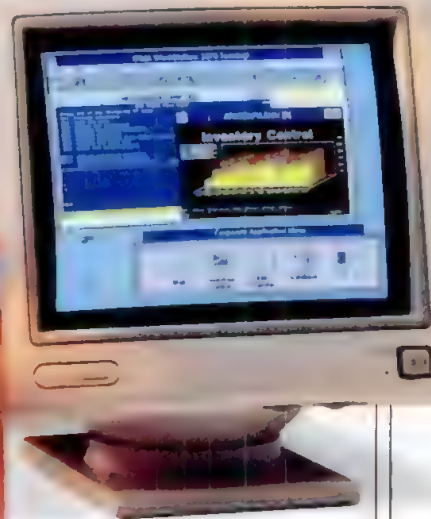


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SERVER 1

- | | |
|---|---------------|
| 486DX-33 | \$2995 |
| Lease: \$108/month | |
| 486DX2-50 | \$3095 |
| Lease: \$102/month | |
| 486DX2-66 | \$3195 |
| Lease: \$105/month | |
| ■ 8MB RAM | |
| ■ High-speed 452MB SCSI hard disk drive | |
| ■ EISA Fast SCSI-2 controller card | |
| ■ 5.25" 1.2MB and 3.5" 1.44MB floppy disk drives | |
| ■ New ergonomic Microsoft Mouse, Microsoft DOS with Enhanced Tools, Windows | |

SERVER 2

- | | |
|---|---------------|
| 486DX-33 | \$3795 |
| Lease: \$125/month | |
| 486DX2-50 | \$3895 |
| Lease: \$129/month | |
| 486DX2-66 | \$3995 |
| Lease: \$132/month | |
| ■ 16MB RAM | |
| ■ High-speed 1GB SCSI hard disk drive | |
| ■ EISA Fast SCSI-2 controller card | |
| ■ 5.25" 1.2MB and 3.5" 1.44MB floppy disk drives | |
| ■ New ergonomic Microsoft Mouse, Microsoft DOS with Enhanced Tools, Windows | |

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- 486SX-33** **\$1395**
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- 4MB RAM
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- 3.5" 1.44MB floppy drive
- On-board VESA local bus SVGA color video with 512K video RAM, upgradable to 1MB
- ZEOS 14" 1024 x 768 SVGA color monitor, tilt and swivel base
- Microsoft DOS with Tools, Microsoft Windows and two-button mouse

PACKAGE 2

- 486SX-25** **\$1595**
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- 486DX-33** **\$1895**
Lease \$69/month
- 8MB RAM
- 340MB IDE hard drive with built-in 128K cache
- 3.5" 1.44MB floppy drive
- On-board VESA local bus SVGA color video with 512K video RAM, upgradable to 1MB
- ZEOS 14" 1024 x 768 SVGA color monitor, tilt and swivel base
- Microsoft DOS with Tools, Microsoft Windows and two-button mouse

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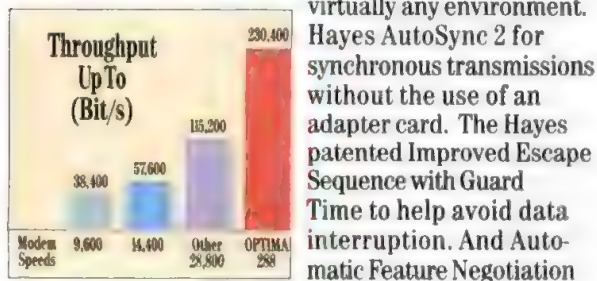
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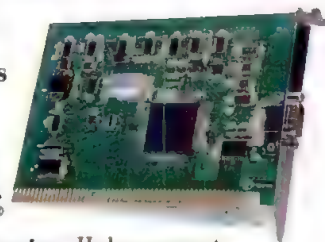


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The Workgroup Generation

Vendors' emerging strategies take root.

Workgroup computing has made it into the buzzword hall of fame, but is it a part of the operating system or an e-mail component? A standalone application or some combination of these ingredients? At least there's agreement on this: A company's work-

group strategy must embrace multiple platforms and mobile users.

Watch for a new generation of workgroup-enabling tools that leverage existing apps. Lotus, which kicked off the workgroup era with Notes in 1989, has coined yet another buzzword—electronic *keiretsu*, a Japanese word for the extended organizational structure that drives Japanese business.

Lotus's Notes-centric environment is a soup-to-nuts solution. An often misunderstood cross-platform client/server app, Notes is based on a compound document with dial-up access and bidirectional replication, which enables remote users to synchronize data on their notebooks (e-mail and Notes databases) with the Notes server via modem. Notes F/X, a data exchange feature, now lets you pump information from desk-top apps into a Notes database. Upcoming components include a Notes development tool called Notebook and the LotusScript macro language. And a long-term project called Video Notes may bring low-cost video conferencing to the desk-top in the near future.

Borland has recently adopted the Macintosh "publish and subscribe" model with a middleware technology called Object Exchange, which builds communications services into existing Windows applications to create compound documents. Obex does not involve replication, version control, data formats, application programming interfaces (APIs), or servers, just an RJ-11 phone jack. It ties together workgroups by transparently sending and updating documents over e-mail systems and networks through the Workgroup Desktop.

Workgroup Desktop was introduced in Quattro Pro 5 for Windows and will appear in an interim release of WordPerfect 6. With the

Workgroup Enabling Kit, power users and developers can retrofit existing Windows apps with Obex, without low-level programming of APIs.

Not surprisingly, Microsoft's workgroup strategy is to embed workgroup services in the Windows platform and to provide an open foundation for application developers. According to Microsoft,

a future version of Windows (code-named Cairo) expected in 1995 will use object-oriented technology that's data-centric rather than application-centric, so you'll be able to link and replicate data, charts, and documents throughout the workgroup. In the meantime, look for Microsoft apps to include delegation and routing features using Microsoft's messaging API (MAPI). Microsoft also plans to deliver group conferencing (or what it calls *group memory*) technology.

While the definition of workgroup computing may remain elusive, chances are you'll know it when you see it. Given the initiatives on the table, workgroup computing is quickly taking shape and is estimated to be a \$2 billion business by 1996.

—Carol Levin

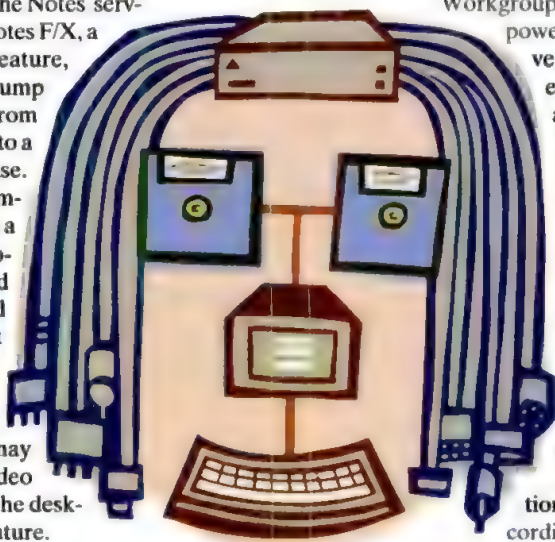
Quick Chip Design

The Pentium wasn't built in a day, but it was built in a lot less time than the 486 was, thanks to Quickturn System's logic emulator. What's a logic emulator? It's a system that lets hardware designers test integrated circuits, such as microprocessors, before committing them to silicon. This saves time and money since the designers' problems and bugs can be fixed in the design stage. And it's one reason why you see new systems every six months.

Here's how it works. Say you're developing a microprocessor. You have the basic design and would like to test the design by running application software on your new chip. The traditional testing method uses software simulation, but this poses a problem: a real-time second on your new chip would take about 14 days to simulate.

A logic emulator acts like a hardware accelerator and takes only about 10 seconds to simulate a real-time second. It does this by mapping the chip design to field-programmable gate arrays (FPGA) that mimic the way the chip operates. Applications and operating systems can then run on the FPGAs before the chip is fabricated.

Intel says it brought Pentium to market faster because of Quickturn's emulation and is using Quickturn in the development of the P6. AMD, Motorola, and Sun Microsystems also use it.—Christopher Barr



Pipeline By Robin Raskin

A Codec Moment

There's a handful of mathematical algorithms called codecs (an abbreviation for compression/decompression) seeking gainful employment as the sponsors of your desktop videos. Codecs work to compress disk-space-swallowing videos without losing essential content. A codec is judged by the quality of the video it produces, its speed in compressing captured video, and its speed in video playback.

The big players are Microsoft with Video 1, Intel with its DVI offspring called Indeo, SuperMac with Cinepak, MPEG (from the group that brought us the JPEG standard for still images), and MediaVision's upcoming Cap'n Crunch. A few esoteric codecs—such as Iterated System's fractal-based VideoBox and a few new powerful codecs such as one from Duck Systems—are making noise in the wings.

A codec's effectiveness is influenced by system processor speed, size of the video playback window, and video frame rate. In many ways, a codec is like a font; one is more effective than another under certain conditions. MPEG produces the epitome of video quality, but it requires hardware. On the other end of the spectrum, Microsoft's Video 1 is a least common denominator codec; it may also be the first orphaned codec, since it's based on an older MediaVision algorithm.

Indeo is the codec on the move. It combines a number of lossy and lossless algorithms to create video that's compact and scal-

able to different systems. It's a little slower than Cinepak at playback but offers real-time capture and compression with high-quality output. Cinepak takes what seems like forever to compress a file, but the playback quality is probably the best of the bunch. Cap'n Crunch isn't shipping yet, but it appears to compress faster than Cinepak without sacrificing much quality. The Apple equivalent of Cinepak is QuickTime (available as QuickTime for Windows). Since QuickTime for Windows video files can only be created on Macs, it probably won't fare well in our market.

You shouldn't have to give a hoot about your codec as long as it's directly supported by extensions to the operating system. Windows users get codec support when they buy Microsoft's Video for Windows, a number of graphics boards, or software such as Adobe Premiere and ATI MediaMerge (see First Looks, November 23, 1993). Video for Windows, Version 1.0 was deficient enough to leave a bad taste for digital video in many mouths. Version 1.1, due momentarily, offers a capable set of upgraded codecs.

Developers have additional concerns. First, they'll need to watch hardware alliances. For example, ATI and Intel launched a now widely adopted Video Device Interface (VDI) spec that lets Indeo talk directly to the video hardware and accelerates the frame rate. Royalty and licensing issues play their part, too, as do support and documentation for the codec's SDK.

So, who's on first? If I were to call a winner, I'd say that Indeo looks right for most of us, most of the time. Somewhere down the road MPEG and its progeny may take the high ground for vertical markets like cable TV, but Indeo could be the codec in your PC life.

Robin Raskin is an executive editor of PC Magazine.

Test Run on the Info Superhighway

LONG BEFORE THE INFORMATION superhighway winds its way through every home in America, a group of scientists and researchers are gearing up for a test run to demonstrate distributed computing over a high-speed network. In the process, the companies building the National Information Infrastructure Testbed (NIIT) hope to turn theory into commercial reality and work through the logistical quagmires that are bound to surface.

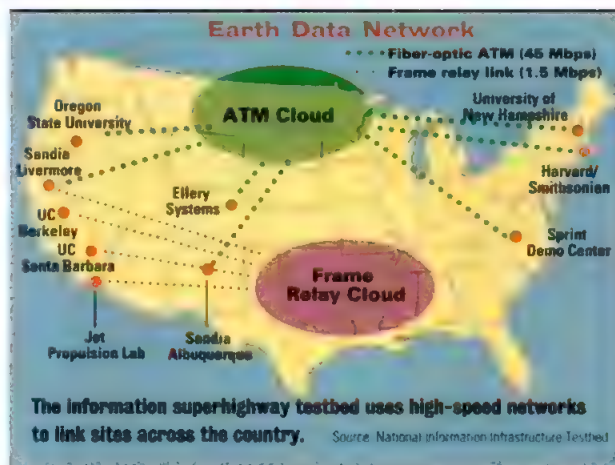
Slated to go on-line in November 1993, the Earth Data System testbed is the first in a series of NIIT experiments. It brings together scientists and policymakers from across the country who are involved in ecological issues. The next one, scheduled for 1994, will tackle health care administration.

Earth Data Systems connects nine sites across in the U.S. into a high-speed network serving 800 gigabytes of video, audio, data, and text. Ethernet or FDDI workstations use TCP/IP protocol to communicate with other sites across the long-distance network's frame relay or asynchronous transfer mode (ATM) switches. The high-bandwidth network runs at 45 megabits per second for fiber optic ATM and 1.5 Mbps

for frame-relay running over T1 circuits.

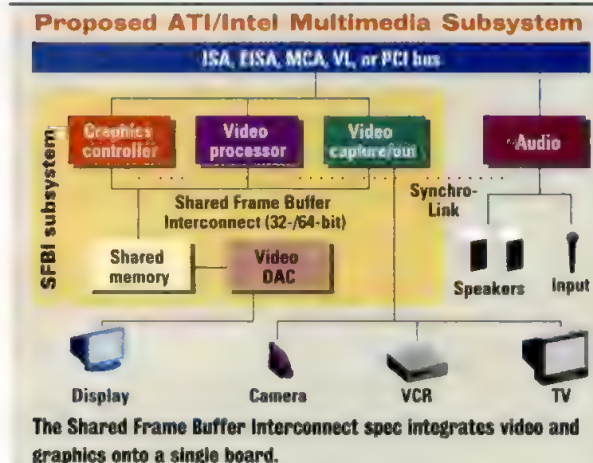
The network is the brainchild of a consortium, including AT&T, Department of Energy, Digital Equipment Corp., Ellery Systems, Hewlett-Packard, Sandia National Labs, Smithsonian Astrophysical Observatory, and Sprint. "The purpose of NIIT is to work out a variety of issues around providing a national information structure, ranging from the technology of interconnection to the business issues of providing the service and the legislative issues regulating this service," says Robert Bismuth of Digital.

The benefits of EDS will be tremendous. Users of the multimedia workgroup application can access information seamlessly, regardless of where that information is geographically located. Access is limited to Unix workstations, though universal access via the Internet is planned. Meanwhile, the NIIT's findings from this dry run will be shared with lawmakers now pondering policies for the future information highway.—Melissa J. Perenson



Can Multimedia Get It Together?

IF YOU WEREN'T CONFUSED ABOUT how hardware companies plan to bring the multimedia world of graphics, video, and sound to your PC, you will be now. In addition to all the sound boards, video capture cards, and codecs available (see Pipeline), now there are two competing multimedia bus specifications.



Earlier this fall, the Video Electronics Standards Association proposed a multimedia video adapter specification, the VESA Media Channel (VMC), that it expects to finalize this month (see Trends, August 1993). Meanwhile, ATI Technologies and Intel were working on their own approach, called the Shared Frame Buffer Memory (SFBM), which the two companies also plan to release to other vendors this month.

The two approaches are based on a single idea: The only way to get full-motion video on a PC economically is to combine multimedia hardware components, such as video compression/decompression (codec) and audio synchronization chips, onto a separate bus or card. In this way, the immense resource requirements of full-motion video (more than 40MB per second for 24-bit color) and sound won't strain a PC's CPU or choke its expansion bus. And, by allowing the different hardware components to share the same video or display memory, single multimedia cards should be less costly.

ATI and Intel's SFBM approach differs from VESA's design in that it supports only 32-bit or 64-bit devices (versus VESA's 8-, 16-, and 32-bit support) and SFBM offers a tighter integration of components on a single card. Video conferencing, graphics con-

troller, and audio chips can communicate directly with each other to coordinate such activities as synchronizing sound and full-motion video. SFBM also includes a specific arbitration scheme so components don't step on each other's toes and describes a common application programming interface (API) for software developers to work with.

Although touted performance specifications for VMC and SFBM look similar on paper, neither VMC nor SFBM products are available yet. The success of either one will depend on how well the first multimedia boards perform. VESA anticipates that

graphics adapters complying with its multimedia bus standard should be available before the end of the year. ATI says SFBM cards will be introduced early next year.

For ATI's part, the company expects VESA- and SFBM-compliant cards to co-exist in the marketplace, with VESA's approach appealing to users who want the option of upgrading and SFBM boards appealing to those who want an all-in-one integrated solution now. ATI plans to introduce its own SFBM real-time video capture and graphics board, the Video Wonder, early next year for around \$1,000. —John R. Quain

The 20% Solution

AN ENGINEERING FACT OF LIFE said PCs were single-speed machines. There was simply no way around the fact that the system's clock crystal determined the pace of computing. Intrepid power users boosted performance by changing the crystal to a faster one, but it was always at the risk of processor meltdown.

Motherboard designers are now looking at ways to give the PC a temporary power boost or to cut electrical use. The Evergreen logic chipset from Pico Power "stretches" clock cycles to cut power use when computing needs are low. This chipset will be the basis of many Energy Star-compliant PCs.

At the other extreme, Elite Computer Systems is working on a motherboard it calls PowerShift, which slows processing to a crawl when computing demands are low and sprints when they're high. "The beauty of the PowerShift design is that it sets the computing speed and performance to suit the user's needs,"

explains Elite's chief engineer Darwin Chang.

It works something like a car's turbo-charger. When you need a temporary burst of speed, the motherboard's synthetic clock crystal raises its speed by about 20 percent for a short period of time, giving you a comparable increase in processing power, say from 20 to 25 MHz. The downside is that the CPU may run hotter than it was designed to. The Elite system monitors CPU temperature and reduces speed prior to burn-out.

The major processor makers agreed that while a PC that anticipates and responds to computing needs is intriguing, it doesn't mitigate the fact that shorter lifetime and lower reliability may result. —Brian Nadel

Top Retail Software

Current ranking	Last issue	Product/company
1	8	Quattro Pro 5.0 for Windows Borland International
2	—	Quicken 3 for Windows Intuit
3	—	Quicken 7 for DOS Intuit
4	—	MS-DOS 6.0 Upgrade Kit Microsoft Corp.
5	5	Microsoft Publisher 2.0 Microsoft Corp.
6	4	Quattro Pro 5.0 for DOS Borland International
7	—	Procomm Plus 2.01 Datastorm Technologies
8	—	WordPerfect 5.2 for Windows WordPerfect Corp.
9	6	Microsoft Office for Windows 3.0 Microsoft Corp.
10	11	QEMM 7.0 Quarterdeck Office Systems
11	10	Lotus 1-2-3, Release 4 for Windows Upgrade Kit Lotus Development Corp.
12	12	Microsoft Access for Windows 1.1 Upgrade Kit Microsoft Corp.
13	—	Harvard Graphics 2.0 Upgrade Kit Software Publishing Corp.
14	1	Procomm Plus for Windows 1.02 Datastorm Technologies
15	—	The Norton Utilities 7.0 Symantec Corp.

This list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending October 2, 1993. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and can not be interpreted as a picture of the entire software market. Sales information compiled by Ingram Micro.

Astro? Elan? Draco?

IT LOOKS LIKE THIS YEAR'S TRICK-
le of PDAs may turn into a gully washer
next year given all the microprocessors now
under development. Besides requiring a 32-
bit computing core, a colorful name seems
to be *de rigueur*. So far PDA processor
chipsets include Dragon, Astro, Elan, Polar,
Draco, and Hobbit. But underneath the
fancy names are PDA-specific cores that
make these processors different from their
desktop brethren.

The upcoming revision of AT&T's Hob-
bit chip, which is used in the EO 440 and
880, will boost EO's capabilities. The new
92020 series is being refined for communica-
tions-oriented applications that will inte-
grate voice and data into one unit. Hobbit
runs Go's PenPoint operating system, which
AT&T recently folded into EO. AT&T has
a financial stake in both Go and EO. Ma-
sushita, NEC, and Toshiba are develop-
ing Hobbit-based PDAs for the Japanese
market.

Elan, Polar, and Draco fall on the Intel-
compatible side of the fence. These highly
integrated chips are well suited to PDAs
because they run for hours on AA batteries,
include built-in PCMCIA and LCD con-
trollers, and take up very little space on the
motherboard. Polar and Draco were devel-
oped by VLSI, with Intel's blessing. Polar
uses a 386 core, Draco uses a 486. Elan is the
brainchild of AMD. While no PDA makers
have yet publicized their plans to use Elan,
Compaq plans to use Polar in its Windows
Companion PDA due in 1994, which is
expected to run Microsoft's WinPad operat-
ing system.

Motorola is developing Dragon and
Astro for its Alarm Clock PDA. Dragon
uses a Motorola 68030 core (which is used in
some Macintosh machines) and provides the
processing equivalent to a 386. It will run
General Magic's Magic Cap operating sys-
tem. Astro, Dragon's companion chip, will
contain the communications-specific con-
trols for the device that will work with
General Magic's Telescript communications
language. Sony is also expected to announce
a Dragon-based PDA in 1994.

NEC, the maker of x86-compatible
V20 and V30 CPUs used in XT and AT-
compatible desktops and portables, has a
new 32-bit RISC processor called the V820.
Like other 32-bit microprocessors, NEC's
CPU is targeted at personal communicators
and other hand-held devices.

—Christopher Barr

Briefs

CONFUSED BY DIGITAL VIDEO TECHNOLOGY?

A new \$49.95 CD-ROM titled Digital
Video Sampler explains it all in a tutorial
and side-by-side videos compressed with
Indeo, Cap'n Crunch, CinePak, Video 1,
RLE, Xing, QuickTime. Learn about
bandwidth, color depth, frame rates, and
more. There's also a product guide. Call
Doceo Publishing at 404-564-5545.

WHAT'S ALL THE FUSS ABOUT THE INTERNET?

If you want to find out but aren't sure
how to go about it, call InterNIC
Information Services at 800-444-4345.
This National Science Foundation pro-
ject provides help for getting into and
around the Internet. The most common
question asked: "How do I hook up my
business to the Internet?"

DO YOU NEED YOUR WALL STREET JOURNAL?

In 1994, Dow Jones Personal Journal will

deliver business news, stock quotes, and
more to PDAs running Microsoft At Work.

AT A SNEAK PREVIEW IN THE BOSTON MUS-

eam of Science, an international audience
got a look at Lotus's experimental desktop
video conferencing technology. The low-
cost, campus-wide system does not require
image compression or decompression.

PEN COMPUTING HITS THE GRIDIRON.

Coaches at the University of Michigan
and other midwestern colleges are using
Athlepad software from Pentech to
draw formations and plays.

AFTER THE JUSTICE DEPARTMENT GAVE

a thumbs down to ChipSoft's bid to buy
MECA Software, maker of Andrew
Tobias' Managing Your Money and
TaxCut, H&R Block has offered \$32.2
million to buy MECA.—Carol Levin

Noisy Notebooks

NOW THAT PC AUDIO IS LESS OF A
luxury and more of a necessity, notebook
manufacturers are breaking into
sealed cases and cramped mother-
boards to add sound components to
the list of standard notebook features.
Notebook feature sets have
traditionally followed
the lead of desktops:
color displays, network
connectors, and mice were
on desktops long be-
fore they were
built into note-
books.

Sound is be-
coming essential for
business presentations, and it
can be used for auditing spreadsheets,
annotating documents, even practicing Japa-
nese lessons.

IBM, Toshiba, and Inex Technologies
now offer notebooks with built-in sound,
and Zenith Data Systems intends to incor-
porate sound into its advanced line of note-
books in 1994. Compaq does not have any
plans to add sound to notebooks.

IBM was the first major vendor to put
sound in a notebook. Its ThinkPad 750 has a
DSP-based audio chip that can handle 16-bit

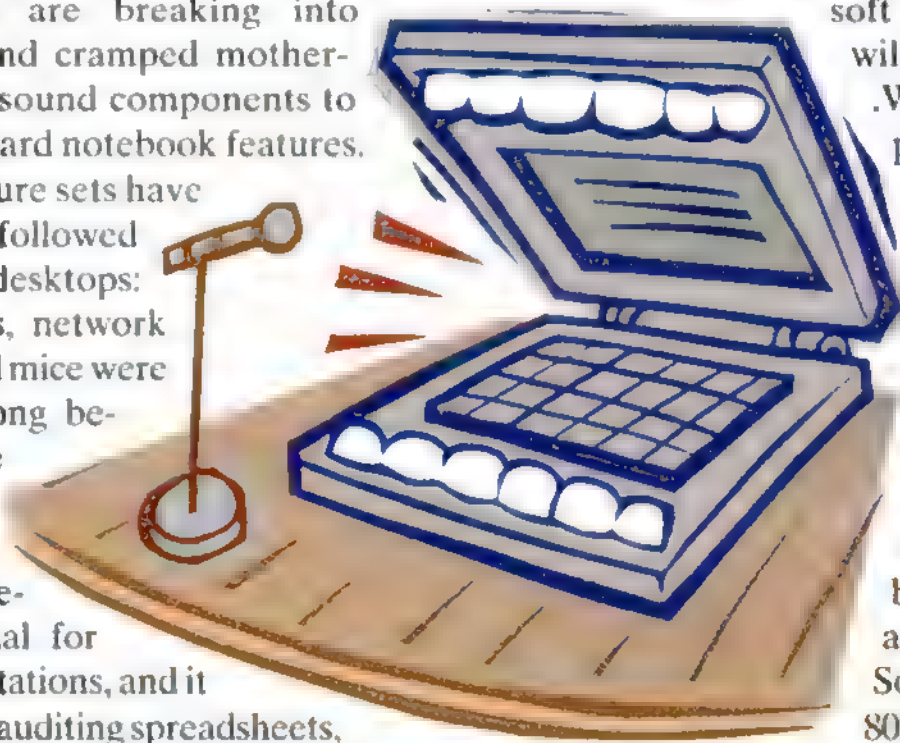
stereo sound. Although the notebook has a
single speaker, there are stereo jacks that
can be used for headphones or external
speakers. Toshiba is also adding sound to its
latest portable, the T4700, which has a color
panel, a built-in microphone, and the Micro-

soft Sound System. It
will record and play
.WAV files, but can't
play MIDI music
files. And it's
strictly mon-
aural, but has
jacks for head-
phones or ex-
ternal speakers.

If you want to
add 16-bit stereo
sound to your note-
book, two options
are available. DSP
Solutions (415-494-
8086) makes the Port-

.Able Sound Plus, with a built-in speaker
and microphone that attaches to the paral-
lel port. It can play 16-bit stereo audio, and
is AdLib- and Sound Blaster-compatible
for games. An elegant PCMCIA sound
solution with jacks for headphones or
speakers will be available soon from New
Media Corp. (800-453-0550). Its Wavjam-
mer PCMCIA card can record and play 16-
bit audio and play MIDI files.

—Christopher Barr



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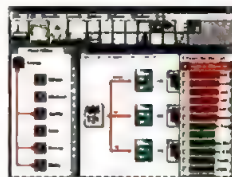


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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ What More Can a Word Processor Do?

WordPerfect 6.0 for Windows Heads Into New Territory

BY EDWARD MENDELSON

WordPerfect 6.0 for Windows performs more functions than just about any other application ever written for the PC. Yet, it makes simple word processing tasks easier to perform than in any previous version of WordPerfect.

WordPerfect Corp.'s \$495 package is far more than a sleek, graphical face on WordPerfect 6.0 for DOS. Starting with the DOS version's built-in spreadsheet, text-retrieval, file-management, collapsible outlining, hypertext, and advanced formatting features, the Windows

version adds automated templates, menu-driven database queries, charting, and a full-featured drawing module complete with scanner support. A full installation needs 33MB of disk

faster than those found in rival packages, doesn't display fonts or formatting.

WordPerfect's database query menu lets you import data from Clipper, DataPerfect, dBASE, FoxPro, Paradox, and major SQL formats. Separate modules linked to the word processor via Object Linking and Embedding (OLE) provide graphics and charting and apply

special effects to fonts. The graphics module lets you import images from Twain-supported scanners. It doesn't allow bitmap editing, but its drawing tools include Bezier curves. WordPerfect's separate modules support the OLE 1.0 specification, but OLE 2.0 support is promised for 1994.

MERGE RIGHT

As in Ami Pro and Microsoft Word for Windows, WordPerfect mail-merges are now entirely menu-driven. When you create or modify a data file, WordPerfect displays a menu with the names of your data fields so you

Continues on page 38



ADDRESSEE: WordPerfect's envelope menu.

space—you can get by with 11MB—and some features are overly complex to use, but anyone who struggled with the awkwardness of WordPerfect for Windows 5.x versions should upgrade immediately.

DOCUMENT MASTER

More than ever, WordPerfect is a complete toolbox for creating and retrieving complex documents. Its QuickFinder file indexer takes seconds to find a memo about needles in a haystack of files. Its unique, time-saving QuickList feature lets you select directories or file specifications using descriptive names and works in every dialog box from which you can select a file. All dialog boxes that access files also include file-management functions, including disk searches and a viewer that, while much

■ Big Blue Keeps New Models Coming Latest PS/1s Focus on Ease Of Use, Energy Savings

BY WILLIAM P. FLANAGAN

With each revision of its PS/1 line of retail PCs, IBM adds enhancements that make using the computer just about as simple as plugging it in and turning it on.

The newest line of IBM PS/1s includes three specially written software programs that not only teach you about the computer and its installed applications, but also teach you how to put those applications to work in your day-to-day routine. IBM has also introduced a Smart Energy System in the new PS/1s. With both a Standby and a Rapid Resume mode, it helps the systems achieve Energy Star compliance.

PC Magazine Labs tested two of the new PS/1 models—a \$2,844 IBM PS/1 Consultant 486DX2/66

minitower system, and a \$2,144 IBM PS/1 Consultant Multimedia 486SX/25 desktop system. The DX2/66 minitower arrived with 8MB RAM, a 424MB hard disk,



POWER TOWER: The top-of-the-line PS/1 is a 66-MHz minitower.

and an internal fax modem, while the multimedia machine came with 4MB RAM, a 256MB hard disk, a double-speed CD-ROM

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► IN FIRST LOOKS

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WordPerfect 6.0

CONTINUED FROM PAGE 37

can enter new records effortlessly. Merges can automatically generate envelopes with bar codes.

About 70 supplied document templates come with custom button bars and other features.



CALENDAR: WordPerfect lets you search by date.

WordPerfect's templates resemble Word for Windows' templates in that they both allow automated text entry. But, unlike Word for Windows, WordPerfect doesn't make you learn its programming language before you construct your own templates.

Menus let you choose macros that run automatically on opening, closing, or printing a file, and supplied macros let you construct fill-in prompts that appear whenever a document is created on the basis of a template.

WordPerfect now lets you edit text on an absolutely clean screen, or you can use any combination of customizable button bars, rulers, and toolbars. A so-called "power bar," accessible from all editing screens, displays icons for basic functions like undo, table formatting, zoom level, and printing. Button bars, which use text or icons or both, give access to standard features, macros, or keystroke scripts that insert boilerplate text. Additional application icons can be

dragged straight from Windows' File Manager to WordPerfect button bars.

Individual button bars can be saved with templates, and specialized button bars can be displayed at any time. Built-in "feature bars" display special icons and drop-down boxes for working with footnotes, outlines, indexing, graphics, hypertext,

sound clips, background images called watermarks, and other advanced features.

TRUE VIEW

All editing screens now use WYSIWYG display. A draft mode displays all formatting except features like headers, footers, and footnotes, which you edit in separate windows that take over the screen. Print preview no longer exists. Page mode, and a new two-page mode, let you edit all features in their true positions on the page. Advanced users will still use the optional reveal-codes screen to manage embedded formatting codes. Fortunately, the display is less ugly than before and lets you delete codes by dragging them out of the window.

Basic word-processing functions for editing and formatting generally equal the standards set by other programs. As in WordPerfect 6.0 for DOS, you can specify first-line indents, left and right indents, and spacing between paragraphs. All format-

ting menus include miniature preview screens, and you can apply customizable borders and fills for paragraphs, columns, or pages with a few mouse clicks.

A "smart quotes" macro automatically inserts typographic quotation marks, but, in a major design error, WordPerfect defaults to ugly, generic quotation marks instead of those built into your fonts. To get the right quotation marks, go to Preferences/Environment, select Code Page, change the Windows Code Page from 1004 to 1252, and restart WordPerfect.

A background printing program quickly returns keyboard control, but not as quickly as in WordPerfect for DOS. The program works smoothly with Windows and WordPerfect printer drivers, but if you turn on automatic kerning with WordPerfect drivers, a bug causes words that begin with "fi" and "fl" to print with extra letters, so you get "floo" instead of "flow." This doesn't happen with Windows drivers.

PROGRESS?

Some features take a step backward from Version 5.x. Despite the addition of quick bullet and numbering menus, custom paragraph numbering is buried so deeply in a confusing outline style feature that it's almost unusable. A new keyboard layout editor makes it harder to find individual functions and, in another major design error, won't let you map keys, like Del and Ins, that can be mapped in every other WordPerfect version.

Other features lack essential options, and you may be confused by the hidden differences between similar functions. An "abbreviations" feature expands a few letters into boilerplate text and always uses the font and format of the text

FACT FILE

WordPerfect 6.0 for Windows

WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; 800-451-5151; 801-225-5000; fax, 801-222-5077

List price: \$495, upgrade, \$129; competitive upgrade, \$149

Requires: 4MB RAM, 11MB hard disk space, Windows 3.1.

In short: WordPerfect 6.0 is the first version to feel truly at home in the Windows environment. And despite some frustrating design flaws, it's one of the most full-featured programs ever developed for creating documents on the PC.

ON READER SERVICE CARD

originally selected. A similar "keystroke script" feature always inserts boilerplate text in the current font. Surprisingly, you still can't customize table of contents or index entries beyond the few built-in options. The bookmark feature is fatally flawed by a design that makes a small bookmark disappear when you define a larger bookmark on top of it. Advanced users of templates and macros may encounter crush-inducing bugs.

Interim releases during the

coming months will address these problems and add new features. Meanwhile, WordPerfect for Windows is one of the most powerful applications ever written for the PC, with unparalleled control over masses of text and other data. A impending new version of Microsoft Word for Windows will offer strong competition in formatting and automation, but WordPerfect for Windows remains unique for its enormous range of functions. Other vendors offer suites of applications, but you may find all the features you need in WordPerfect alone. □



From November 29 through December 3, you can go on-line to download a demo of WordPerfect for Windows or to discuss the program with Ed Mendelson and WordPerfect technical product manager Dave LeFevre. Type GO EXEC from any CompuServe prompt.

IBM PS/1

CONTINUED FROM PAGE 37

drive, and a Sound Blaster 16 sound card.

The PS/1 Index, the first of three new software utilities, contains a series of concise lessons on how to do many of the tasks that you buy a computer to perform. From calculating loan amortizations and creating budgets to recording macros and even cleaning the computer, the PS/1 Index has a lesson covering the chore. The PS/1 Tutorial features Windows Lessons and Software Descriptions. The latter gives you a brief summary of the installed software, which includes America Online, Prodigy, and Microsoft Works.

PS/1 Fitness adds easy-to-understand dialog boxes to such MS-DOS 6.0 utilities as Microsoft Antivirus and Microsoft Backup. When you click on Virus Check, for example, you get a plain-English explanation of your options, and once you choose an option, you're launched directly into the MS-DOS utility. Other parts of PS/1 Fitness include a tool for showing system information and one for changing display resolutions.

POWER SAVER

The system's Standby mode forces the system into a low-power state and blanks the display after a user-defined time period ranging from 15 to 90 minutes. Interestingly, in Standby mode, PS/1s don't quite conform to Energy Star guidelines. To get the rating a system must be capable of entering a "low-power state" in which it consumes less than 30 watts. PS/1s get their Energy Star rating through the Rapid Resume feature, which turns the system off after a period of inactivity and restores it to its previous state when you turn it back on.

Both PS/1 Consultants are designed to run right out of the box, with an emphasis on ease of use rather than performance. With that in mind, PC Labs ran

informal benchmark tests and found that, out of the box, with features like DOS's DoubleSpace installed, the new PS/1s offered very poor performance. When we tweaked the system (by defragmenting the hard disk and increasing the size of the SmartDrive cache), each system performed closer to the average

for comparably configured PCs. Both systems lagged far behind on disk tests due to the lack of a caching controller, but both did well on video tests.

The novice who buys a PS/1 for its user friendliness may not notice that it doesn't perform up to many 486 standards, but anyone who wants more out of a sys-

tem shouldn't, and probably wouldn't, look to the PS/1 line.

•List price: *IBM PS/1 Consultant 486DX2/66*, \$2,399; *IBM PS/1 Multimedia 486SX/25*, \$1,699 (monitor options extra). *IBM Personal Computer Co., Rte. 100, Somers, NY 10589; 800-772-2227, 914-766-1900; fax, 800-426-4329.*

Circle 432 on reader service card

PCs

DeskStation's MIPS-Based System Targets NT Work

BY AMARENDRA SINGH

The fact that Microsoft Windows NT is portable to a number of different CPU architectures has set the stage for a new generation of PCs based on RISC processors. DeskStation Technology's \$4,995 DeskStation Evolution Series rPC/44 is its most recent MIPS R4400-based machine aimed at Windows NT developers. A member of DeskStation's Evolution family, it is also the first generally available machine of its type we've seen.

The DeskStation system looks like many PC clones because it is based on an AT motherboard. The basic difference is the additional logic required for the R4400 bus to communicate with the EISA bus. DeskStation also developed the ARCS-BIOS code, which provides the ROM-based software required to install and boot Windows NT. The memory bus is only 32 bits wide, while the CPU itself has a 64-bit-wide path; therefore 512K of secondary cache is used to enhance performance. The

MIPS R4400 CPU itself runs at 50 MHz externally and 100 MHz internally.

The tower case holds six EISA slots; of these, four hold an I/O/floppy disk drive controller, a Fahrenheit 1280 video



NEW WORLD: The DeskStation has an R4400 chip.

board, a Standard Microsystems Ethernet adapter, and an Adaptec SCSI controller. Three of the seven available drive bays hold a 3.5-inch floppy disk drive, a Sony CD-ROM drive, and a 500MB Maxtor hard disk.

Interpreting the DeskStation's test results is an inexact science. The only other MIPS R4400-based machine we tested was a development system built entirely around an R4400, which ran at 75 MHz externally and 150 MHz internally (see "Windows NT: See How It Runs," September 28, 1993). As expected, the DeskStation's numbers couldn't compare with those of a 75-MHz system except in disk performance, where the DeskStation's Maxtor drive proved powerful. When we compared the DeskStation with an NCR system running with a 66-MHz Pentium processor, we found mixed results. One thing the DeskStation system has going for it is the EISA architecture, which makes it compatible with many of today's peripherals. We'll have to wait for true Windows NT applications, however, before realistically measuring the performance of MIPS R4400-based systems.

•List price: *DeskStation Evolution Series rPC/44*, starting at \$4,495. *DeskStation Technology Inc., 13256 W. 98th St., Lenexa, KS 66215; 800-793-3375, 913-599-1900; fax, 913-599-4024.*

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Performance Tests: DeskStation Evolution rPC/44

PC Magazine Labs has compiled these tests for each processor, using processor-specific optimizations. It is important to note that no two processors were running at the same speed on these tests.

	Floating-Point Performance (cycles per second)					Processor (operations per second)	Disk (kilobytes per second)	Graphics (millions of pixels per second)
	Distribution	Fourier	Linear	Orbital	Polygon			
DeskStation Evolution rPC/44 (50-MHz MIPS R4400)	28.4	73.8	339.3	343.9	391.6	7.6	687	6.0
MIPS Magnum PC (75-MHz MIPS R4400)	43.0	241.7	510.2	555.9	591.2	13.8	445	20.6
NCR System 3360 Panther (66-MHz Intel Pentium)	74.6	156.9	323.5	575.1	262.1	8.6	446	3.6

Application Development

Synergy Builds Procedures Out of Windows Apps

BY STEPHEN W. PLAIN

Automating tasks between Windows applications with protocols such as DDE and OLE is usually a frustrating task and often yields unpredictable results. Prodea Software Corp.'s \$495 ProdeaSynergy, a visual development tool that helps you leverage the power of your existing Windows applications while

Applications Services Database layer within the product contains all of the protocol and file format compatibility information needed for your installed applications. The standard database shipped with the product supports 27 popular applications, and you can add definitions for other applications.

You create packages by dragging icons that represent

MULTILAYERED

The Synergy Library component included with the product lets you present groups of packages in the form of a multilayered menu system of push buttons. You can have the menu system appear with rectangular buttons, large square buttons, or as a simple list box.

The Library component contains rudimentary security protection through the use of passwords, and any restrictions defined for documents in their native applications are still enforced. Although the Library is designed as the end-user interface to packages, it is not a separate standalone module; each installation still includes the Workspace.

In addition to the Workspace and Library, a third major component, the Variable Server, is the key for truly customized package design. The Variable Server keeps track of a set of variables that can be defined from within the Workspace or the individual applications. By using variables to indicate scenarios at runtime, you can define a rule-based system that will react appropriately in different circumstances.

To define conditional transfers of data, you use a special arrow that has an associated dialog to define conditions through an easy-to-follow point-and-click method.

TROUBLESHOOTING

As the complexity of your package grows, so does the chance of something going wrong. Synergy offers a couple of features to help you

debug a misbehaving package. While executing a package from within the Workspace, you can step through each part of the process, checking the values of variables and application behavior along the way. There is no breakpoint feature, however, to stop execution automatically based on a variable's value. In normal operation, each icon is highlighted as it is executed. If the order of execution is in question, you can use the "Show Run" feature to simulate the process without actually running any applications.

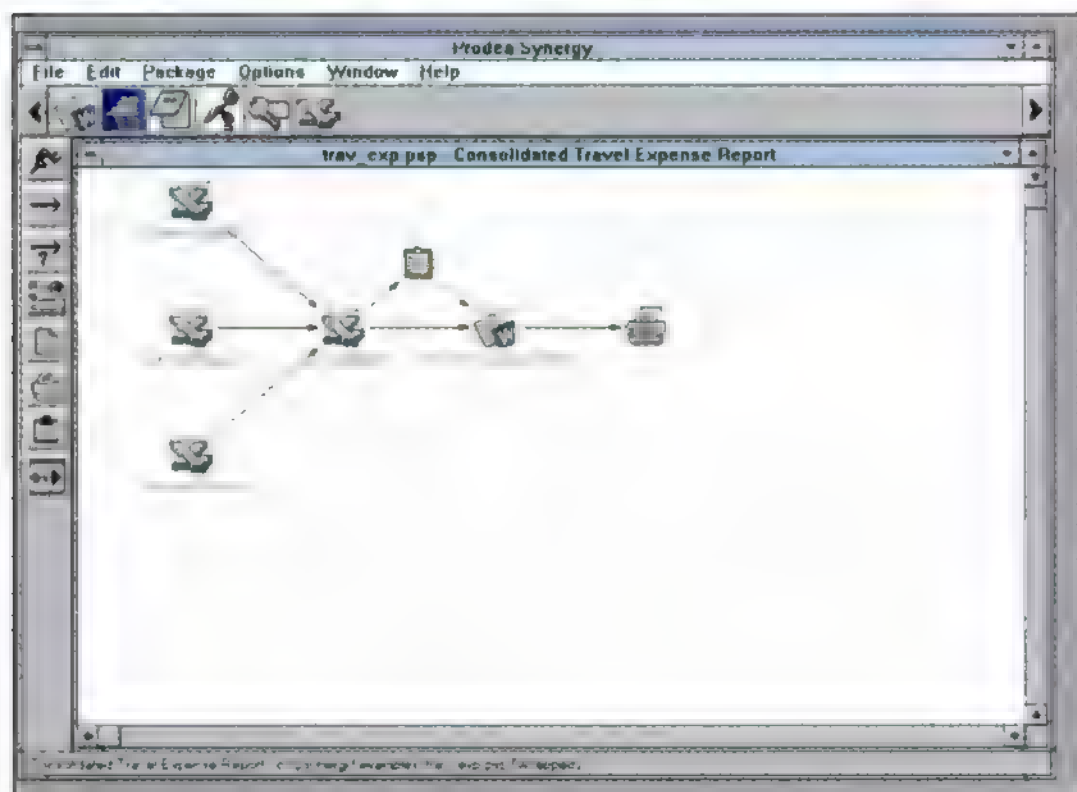
One of the biggest problems frequently encountered when using OLE is changes in the location of linked files. Synergy deals with this by dynamically binding the packages to applications. This means that the location of the user's applications is stored separately, at installation time, from the package and resolved at runtime. This way, packages can be distributed without modification to users with different directory structures and still work.

Synergy is a valuable tool for organizations that make heavy use of predefined procedures involving multiple applications. It can simplify operations tremendously for offices that have rotating personnel with varying degrees of computer proficiency. \$500 per desktop is a bit

pricey, however, for wide deployment. The company aggressively negotiates volume discounts with customers, but offers no limited-use runtime versions of the product.

• List price: *Prodea-Synergy 1.1*, \$495; 10-user license, \$4,500. Requires: 2MB RAM, 3MB hard disk space, Windows 3.1. Prodea Software Corp., 11095 Viking Dr., #225, Eden Prairie, MN 55344; 800-776-3321, 612-942-1000; fax, 612-942-1010.

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CONNECT THE APPS: Create procedures by drawing relationships.

eliminating many of the headaches of application integration, is geared toward people who build such custom creations, as well as those who use them.

Synergy lets you create software "packages" that can use multiple applications to perform complex data manipulation with just a click of the mouse.

The product automatically uses the appropriate data-transfer protocol between supported applications, freeing you to concentrate on the data you want to move, not on how to move it.

The program takes advantage of DDE, OLE, MAPI, VIM, or macroed keystrokes to provide communication between programs. An updateable

your Windows apps from a toolbar into the Synergy Workspace, then connecting them with arrows to form a visual representation of the data flow. Icons for printers, fax modems, and the Windows Clipboard also go in the diagram.

Once dropped into the Workspace, each icon has an associated properties box that lets you define the particular document to be opened and its characteristics. By modifying preferences for the connecting arrows, you define the range of data to be moved from the source document and where to put it in the destination. The order in which data transfer operations are performed is defined by where you place the icons.



From November 22 through November 26, you can go on-line to download a demo of Synergy or to discuss the program with Stephen Plain and Prodea president Larry Barbetta. Type GO EXEC from any Compu-Serve prompt.

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CIRCLE 292 ON READER SERVICE CARD

Monitors

IBM Debuts 21-Inch Display; NEC Extends MultiSync Line

BY JOHN R. QUAIN

Three new monitors are bringing Energy Star power efficiency to PC users. IBM's 21-inch, \$2,245 21P monitor is aimed at professional graphics users, while NEC's latest offerings, the \$1,455 17-inch MultiSync 5FGp and \$550 15-inch MultiSync 3V, are targeted at business users and cost-conscious buyers.

The IBM 21P represents a number of firsts. It's the first 21-inch entry from Big Blue, as well as the first IBM monitor outfitted with a connector for Macintosh systems. More importantly, it's the first monitor we've tested that uses Mitsubishi's vertically flat Diamondtron tube.

Shaped like a Sony Trinitron tube, the Mitsubishi tube is bright and accurate. Using a 0.31-mm striped aperture grill (like Sony's design), the Mitsubishi-based multifrequency monitor has a maximum noninterlaced resolution of 1,600-by-1,200 with a 60-Hz vertical refresh rate. IBM's optimal recommended display resolution, however, is 1,280-by-1,024 at 77 Hz.

Subjective tests demonstrated that this monitor was made for high-resolution graphics. It delivers an unwavering image in 1,024-by-768 mode, yielding excellent brightness, a tight focus, and solid colors. Images in 1,280-by-1,024 mode are nearly as ideal, relinquishing only a bit of sharpness in the corners.

Demanding DTP users will find that IBM has included all the necessary digital controls on the IBM 21P. The front panel has size and position controls, trapezoidal and convergence buttons, and controls to adjust the red, green, and blue colors.

In addition to the VGA and Macintosh inputs, the monitor has BNC connections for high-end graphics cards.

NEW NEC MODELS

Meanwhile, NEC continues to revise its line, replacing the 5FG with the 5FGp. The new model retains its attractive chassis and easy-to-follow digital controls for image size, position, and RGB color. Rear panel jacks can handle Macintosh VGA and full BNC hookups.



around tightly spaced letters right up to the 1,024-by-768 noninterlaced resolution. Images remain stable even in the monitor's maximum resolution of 1,280 by 1,024 pixels, which has a vertical refresh rate of 74 Hz.



NEW VIEWS: The IBM 21P (above), IBM's first Mac-ready monitor; the NEC 3V (left), just \$550; and the NEC 5FGp (below), with special anti-glare coating.



NEC has replaced the bright but highly reflective glass on the 5FGp with an OptiClear antiglare coating. Rather than using an etched screen or silica coating approach to diffuse reflected light, the OptiClear coating actually absorbs some ambient light, according to NEC. It's a better approach than offering an optional antiglare lens, which NEC did previously.

The OptiClear coating doesn't sacrifice image detail, and it reduces glare significantly. The 5FGp maintains excellent brightness and an accurate focus extending out to the extreme corners of the screen. Image detail, color saturation, and sharpness are also commendable, with crisp edges

analog image size and position controls are located up front.

Although the 3V will reach a maximum noninterlaced resolution of 1,024-by-768 with a 60-Hz refresh rate, the monitor is more comfortable in VGA (640-by-480 at 75 Hz) or SuperVGA (800-by-600 at 72 Hz) resolutions. In the latter mode, we observed some focus degradation, making this monitor more appropriate for basic office VGA work.

POWER SAVING TESTS

IBM's 21P easily meets the Energy Star requirement of consuming 30 watts or less while inactive. In Windows at 1,024-by-768 mode, the 21P draws 117 watts. In Suspend mode, the monitor drifts down to less than 19 watts.

Oddly, when the Off mode is enabled, the IBM 21P completely shuts off (unlike other monitors, which simply go into a deeper sleep mode). To reawaken the monitor from the Off mode, hit the front-panel power button.

Energy Star testing of the NEC monitors' power-saving Suspend mode revealed that the monitors met the EPA's 30-watt power consumption rating. The 5FGp went from a power consumption rating of 113 watts in Windows down to 30 watts, while the 3V went from 64 watts in Windows down to 26 watts. According to NEC, concern about the time it takes to return from a full sleep mode, in which the heaters for the monitor's electron gun are shut off, contributed to the decision not to reduce power consumption further on these models.

• List price: IBM 21P, \$2,245. IBM Personal Computer Co., Rte. 100, Somers, NY 10589; 800-772-2227; fax, 800-426-4329.

Circle 430 on reader service card

• Estimated selling price: NEC MultiSync 3V, \$550. NEC MultiSync 5FGp, \$1,455. NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; 800-388-8888, 508-264-8000.

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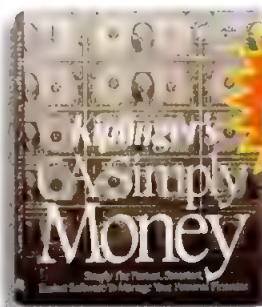
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■ Ink Jet Printers

Canon BJC-600: Four-Color Ink Jet Printing for \$719

BY GREG PASTRICK

Despite the falling prices of laser printers, the high-quality ink jet market continues to thrive. More and more users are looking for color output at a reasonable price, and Canon Computer System's \$719 four-color BJC-600 meets this demand handily.

With the BJC-600, Canon uses four 64-nozzle printheads that distribute colors cleanly on a variety of paper stock without banding or bleeding. Measuring 6.8 by 16.1 by 10 inches (HWD), the BJC-600 resembles the company's latest fax machine release. Street prices for this new bubble jet are expected to hover around \$650, with the miniature color ink tanks retailing for \$8 each. Black sells for \$7.50.

With a maximum resolution of 360 by 360 dpi, the BJC-600 is a free standing, 10.15-pound printer designed to use 1.4 by 1.9-inch snap-in ink cartridges in its integrated printheads—one each for cyan, magenta, yellow, and black. Unlike conventional

black and color ink jet cartridges, only the dry ink tank gets replaced when the ink runs out. This reduces consumable costs and makes the printer easier to maintain. Each of the miniature tanks hold about 10 grams of ink and is rated to print up to 600,000 characters in draft mode—half that number in letter quality. According to Canon, this translates to about 210 pages-per-cartridge for spot and small-size graphics and up to 700 pages of text in high-speed draft mode.

The BJC-600's integrated printheads, rated for the life of the printer, are just one of the new features of the color bubble jet. Bidirectional printing, an enhanced Windows driver with 24-bit screen-matching color capabilities, and third-party PostScript interpreter compatibility extend its versatility.

The BJC-600 is a fully self-contained unit with a top-centered control panel, a 100-page input tray, and a lone, 8-bit parallel interface. It comes standard with a 60K buffer, power cord, Windows installation software, and a Bitstream TrueType font pack with 20 typefaces as an add-on to its resident Courier, Orator, Prestige, Roman, and Sans Serif fonts.

The BJC-600 has BJ-10, Epson LQ-2550, and IBM Proprinter X24E text and graphics emulation; it

is rated for 240-cps printing speeds in draft mode and 170 cps in letter quality. Actual print speeds on our tests in Epson LQ mode proved to be much slower. Set to its high-quality print mode, the BJC-600 printed our text and graphics files at a little over 1 page per minute or 1 graphics page per minute. While the speed may not be exceptional on our tests, the color quality and text character formation of the BJC truly is.

BEST COLOR CREATION

Unlike HP's new color ink jet, the portable DeskJet 310 (First Looks, November 23, 1993), the BJC-600 makes full four-color output. Where the DeskJet uses a three-color cartridge (cyan, magenta, and yellow inks) with a separate black cartridge for black text, the BJC-600 is a dual solution. You



DUAL MODE:

Text and graphics use the same cartridges.

get color printing on demand without the need to change modes or cartridges.

The combined injection of four colored inks, instead of three, results in truer color output. With the BJC-600 black prints as black, not a combination of cyan, magenta, and yellow which, on the DeskJet, produces a green cast. By adding black to the mix, the BJC-600 produces deeper, richer color output across all color combinations.

Calibrating color output to match what you see on-screen is often of dubious value, since what you see is largely affected by uncontrollable variables like ambient lighting and the color

FACT FILE

Canon BJC-600

Canon Computer Systems Inc.,
2995 Redhill Ave.,
Costa Mesa, CA 92626;
800-848-4123; 714-438-3444;
fax, 714-438-3317

List price: \$719.

In short: Canon has optimized its bubble jet technology and introduced a unique 256-nozzle printhead and replaceable ink tank system to deliver high-quality four-color output with the BJC-600

ON READER SERVICE CARD

characteristics of the monitor and video card. And the BJC-600's automatic color matching support for a variety of common high-resolution displays achieves only a close approximation of a match between on-screen and output color. Even so, the BJC's Windows driver is good at matching image and output intensity.

EASY MAINTENANCE

The BJC-600 is just as trouble free to use as it is to set up and maintain. You access all the basic control functions directly from the well-designed control panel and set options through the printer's Windows driver. Special options such as halftone effects and screen color matching are also enabled through the driver.

As for raw mechanical operation, the BJC-600 handles standard letter-sized paper and envelopes without jamming. However, heavy ink saturation from printing graphics at full page widths and beyond half-page lengths tends to curl light paper stocks. If you need to print heavy graphics, go to a heavy stock. The printer can handle up to 28-pound paper in manual feed mode and 24-pound in automatic paper feed.

The BJC-600's simplicity in design, ease of use, integration of evolved technology, and high-quality output secure its place as a top buy for the home office or small business. □



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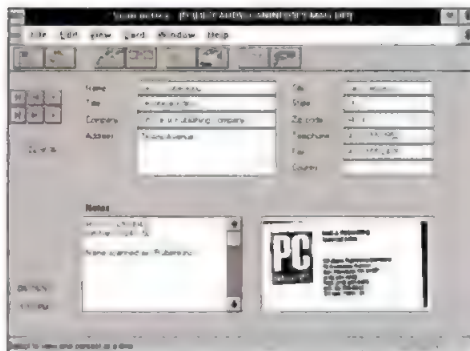
CIRCLE 226 ON READER SERVICE CARD

■ Business Card Scanners

Nice to Scan You: Three Ways to Get Cards into Databases

BY NEIL J. RUBENKING

You spend a week on a business trip and arrive home with dozens of business cards. Now what do you do? Sit down and type them all into your favorite PIM? Rubber-band the stack and toss it into a drawer? If you're a Windows user, you can avoid these low-tech solutions using one of several new products that were designed to scan and read business cards.



SCAN-IN-DEX: Easy-to-use interface.

Microtek's Scan-In-Dex and CypherTech's CypherScan 1000 come with a special business card scanner, while Cognitive Technology's Business Card Reader works with your existing scanner. The programs use optical character recognition (OCR) to extract the text from the card's scanned image. After that, sophisticated pattern-recognition algorithms interpret each chunk of text as a name, title, phone number, or address.

SCAN-IN-DEX

The software portion of Microtek's \$399 Scan-In-Dex is a simple but serviceable address database. It stores ten data fields including name, title, company,

address, phone, and fax information, plus an all-purpose notes field. To scan a business card, you just put it on the scanner, click the Scan button on the toolbar, and wait for data to appear in the fields. If the software places an entry in the wrong field, dragging it to the right field will exchange the values of the two fields. Text that can't be interpreted gets dumped in the Notes area, and you can drag marked text from Notes into other fields.

Fill in one or more fields in a query form and Scan-In-Dex displays all matching cards (matching means the string you typed is found within the field, so "Ben" matches "Neil Rubenking"). You can also switch to a spreadsheet-style

list display and sort the cards by name or company. Unlike the other two programs, Scan-In-Dex lets you open multiple card files at once and drag cards from one to another. Dragging all your cards to a new file is a good way to pack the database, regaining wasted space that was occupied by deleted cards or card images. (A card image takes about 5K of disk space.)

Scan-In-Dex will export its database in comma-delimited, tab-delimited, or plain text format, optionally putting the field names in the first record. It will also print a listing of all cards or selected cards, with user-defined

field placement and formatting.

In our informal testing, Scan-In-Dex was especially good at interpreting cards with two or more addresses in parallel columns. However, it occasionally came up with a surprise, like converting a "Senior Marketing Manager" into a "Telemarketing Manager". It also seemed to mistake digits for letters in phone numbers more often than the other two products.

• **List price:** *Scan-In-Dex, Version 1.1*, \$399. Requires: 8-bit or 16-bit slot, 4MB RAM (8MB recommended), 6MB hard disk space, expansion slot, Windows 3.1. Microtek Lab Inc., 680 Knox St., Torrance, CA 90502; 800-654-4160, 213-321-2121; fax, 310-538-1193.

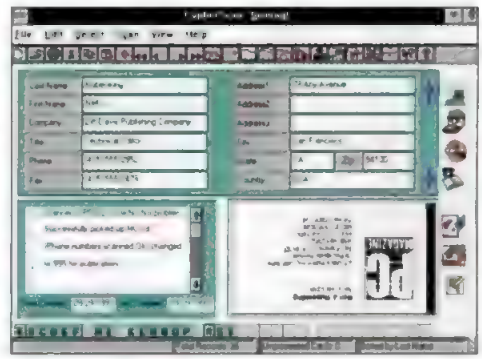
Circle 401 on reader service card

CYPHERSCAN 1000

CypherTech's \$395 CypherScan 1000 uses the same hardware as Scan-In-Dex, but its software is richer in features. It includes an extensive tutorial, and its help system is context-sensitive. It displays over three dozen database fields (ten of them user-defined)

MCI and Internet addresses. Most impressive, you can drag recognized text directly from the card image to any field.

CypherScan lets you override the automatic selection of scanning intensity for especially light or dark cards. Scanned a card upside-down? Just select



CYPHERSCAN 1000: Scan all four orientations.

upside-down from the four choices of orientation. In batch mode, you scan cards as fast as the scanner will accept them, then take a break while the software processes all the images.

OCR is not an exact science, and CypherScan recognizes this fact by providing an Uncertainty button on the toolbar. Click this button and fields that were uncertain will be marked with a red dot, while dubious areas on the card image will be outlined in red.

CypherScan makes it easy to delete card images, but the card folder view may convince you to retain them. It displays six images at a time, allowing you to flip through your collection looking for a card with a particular logo. Each record can also include a secondary scanned image the size of a business card—for example, notes from the back of the card.

The program will import and export Lotus Organizer files directly, export ACT files directly, and import or export comma-delimited files. It has a wealth of report printing options, including mailing label and phone list printing.

CypherScan has some minor

Continues on page 48



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Card Scanners

CONTINUED FROM PAGE 46

glitches that will be worked out in its next version. For example, it has trouble interpreting two-word state names like New York, and names ending with Jr. or III. But on the whole it's dependable and easy to use, and you're not likely to outgrow its database.

- List price: *CypherScan 1000*, \$395; *CypherScan HF-Flatbed* (software only), \$245; *CypherScan HF-Handheld* (software only), \$145. Requires: 6MB RAM, 10MB hard disk space, expansion slot, Windows 3.0 or later. CypherTech Inc., 250 Caribbean Dr., Sunnyvale, CA 94089; 800-294-7226; 408-734-8765; fax, 408-734-8763.

Circle 402 on reader service card

BUSINESS CARD READER

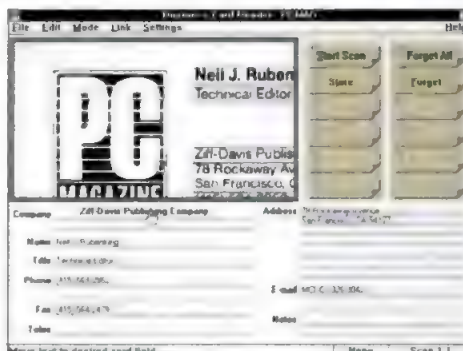
If you already have one of the more than 60 scanners support-

ed by Cognitive Technology's Business Card Reader (BCR), it's a bargain at \$99. Depending on your scanner, it will scan up to eight cards at a time. During the initial processing of a scanned card, you can drag text directly from the card image to fields of the database. BCR will optionally display the card data in a spreadsheet-style list or as a deck of card images.

BCR's adaptive threshold scanning helped it read some low-contrast cards that gave the other programs trouble, and it's the only one of the three that recognizes Telex numbers automatically. It also interprets CompuServe, MCI, and Internet e-mail addresses, and its phone

field will hold four different numbers and auto-dial them at the click of a button.

BCR's database is very easy to use but limited. It has just nine fields, and the entire



BUSINESS CARD READER: Drag text around.

address occupies a single field, making it impossible to search or sort by state or ZIP code. You can't save disk space by deleting the card images after they have been processed; you can't simply type in a new card by

hand; and vertical cards aren't supported. BCR will export to Lotus Organizer or to .DBF format but won't print out its data directly. However, you don't necessarily need all these features, and Cognitive Technology plans an enhanced version of the program.

If you don't already have a scanner, the CypherTech 1000 is your best choice. If you do have a scanner, you'll have to choose between CypherScan and BCR. CypherScan's software-only versions support HP ScanJet or Logitech handheld scanners; BCR supports over 60 scanners and costs less.

- List price: *Business Card Reader*, \$99. Requires: 4MB RAM, 4MB hard disk space, Windows 3.0 or later, scanner. Cognitive Technology, 100 Larkspur Landing Circle, #106, Larkspur, CA 94939; 415-925-0707; fax, 415-461-4010.

Circle 403 on reader service card

■ Alternate Input

WinTrac: A Trackball Made With Windows in Mind

BY MITT JONES

MicroSpeed's \$129 WinTrac may not convince huge numbers of mouse lovers to give up their desktop pets, but innovations in both its design and its software promise to make it a top choice for those who prefer trackballs.

The large, sloping form of the trackball itself—which measures 2.5 by 3.9 by 7.25 inches (HWD)—should comfortably support the hands of both Davids and Goliaths. The trackball design, which frames the 2.25-inch-diameter ball with two oversized buttons, accommodates right- and left-handed users equally well.

The more obvious innovations involve a third button and a horizontal wheel placed above the ball, along with software (in both DOS and Windows versions) that helps you put these controls to good use.

The WinTrac offers Microsoft Mouse compatibility, but its software installation routine automatically adds its own driver to Windows, adding a WinTrac icon to the Windows Control Panel in the process.

To do away with one of the more difficult chores required by most trackballs—holding down a

button with one finger while rolling the trackball with the remainder of the hand—the control panel also enables drag lock and auto drag. With drag lock on, a click of the button configured for that function initiates dragging. A second click completes the operation. Auto drag provides a handy, often preferable alternative: Holding down the primary button for a period longer than a user-definable delay setting (0.4 seconds as a default) initiates a drag.

A second WinTrac icon activates the WinTrac's in-depth application profile capability. Each predefined or user-defined profile defines the behavior of the WinTrac for a given application, allowing the assignment of as many as 40 keystrokes to each button and each of numerous Alt-, Ctrl-,

and Shift-button combinations. When enabled, the profile Tracker automatically activates the appropriate profile when you enter a given application. A default profile goes into effect if no application-specific profile exists.

The 13 profiles provided for Windows applications show the profile capability at its best. With most apps, the small, third button on the WinTrac accesses the application's menu bar without abandoning the cursor location within the open document. Rolling the trackwheel above the third button typically scrolls the document vertically within its window.

If you're accustomed to a mouse, the action of the WinTrac and the behavior of its software features will take some getting used to. If you try it, make sure you resist the urge to scurry back to your mouse for at least a couple of weeks.

- List price: *WinTrac*, \$129. Requires: Serial port. MicroSpeed Inc., 5005 Brandin Ct., Fremont, CA 94538; 510-490-1403; fax, 510-490-1665.

Circle 425 on reader service card



UNUSUAL DESIGN: WinTrac has a trackwheel.



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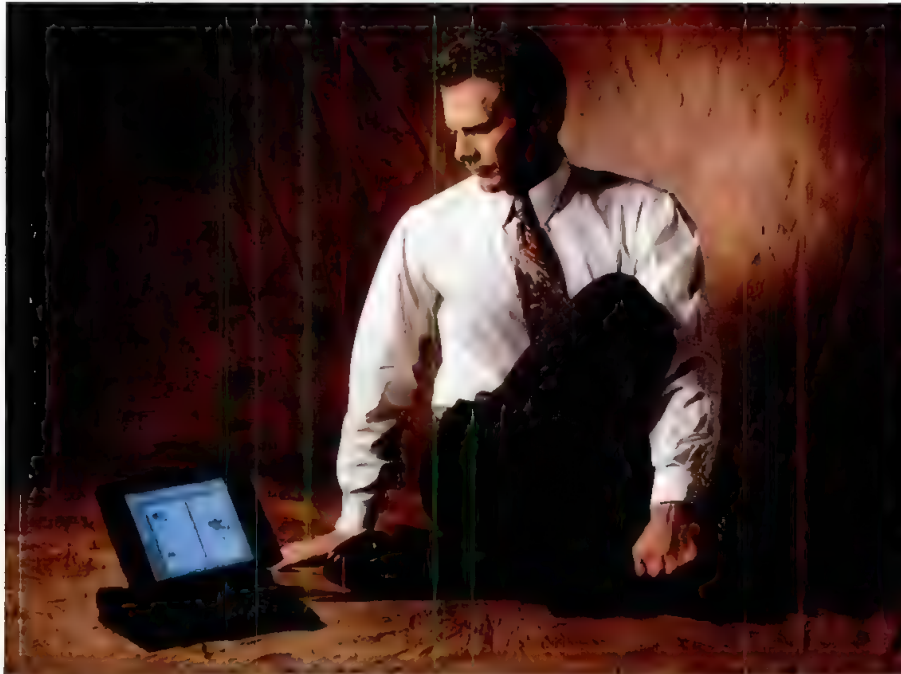
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The ZEOS ColorNote... scaling new heights.



With color and power you can't beat, the ZEOS ColorNote 486 is the only color notebook worth taking note!

We started with a reliable 486SX Intel processor running at 33MHz. Then we loaded it with



ZEOS dual scan screen (left) fires up rich, vibrant colors while standard passive matrix screen (right) produces faded and dull colors. Photos are not retouched.

enough memory and power to run Windows: 4MB or 8MB RAM (expandable to 20MB), an 80MB, 120MB or 170MB IDE hard drive and an 8K built-in cache. And, we added local bus video for super-fast video performance.

Blazing colors seem to sing. Images are vibrant and alive. For a crisp VGA backlit screen displaying up to 256 colors, the ColorNote employs dual scan technology—a breakthrough that achieves color comparable to that of a

desktop color monitor yet not as expensive as active matrix.

What's more, it comes equipped with a PCMCIA slot, an internal floppy drive, built-in trackball and a Nickel-Metal Hydride battery. If your

needs go beyond the standard scale, you can compose a personalized package with our many options. Let the ColorNote be the basis for your creative scores and presentations.

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- IDE hard drive expandable to 170MB.
- 8K internal cache.
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- 512K video RAM.
- Local bus video for super-fast video performance.
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- AC adapter from AC110-240V to DC.
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- FCC Certified Class B; UL Listed.
- Complete ZEOS Customer Satisfaction Package.

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Lease \$87/month

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- 80MB IDE hard drive

PACKAGE 2

ColorNote 486: \$2695

Lease \$97/month

- 4MB RAM
- 120MB IDE hard drive
- Microsoft DOS
- Microsoft Windows
- Lotus Organizer

PACKAGE 3

ColorNote 486: \$2995

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- 8MB RAM
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- Custom leather carrying case
- Microsoft DOS
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■ Personal Finance

Quicken's New Calendar: Brilliant Ease-Of-Use Touch

BY CHRIS SHIPLEY

Less than a year ago, in bestowing Editors' Choice awards on Intuit's two Quicken products, we wrote that the personal finance managers were "the uncontested ease-of-use champion(s) in this category." At the time, it was difficult to imagine that these programs—one running in DOS, the other under Windows—could get any better or any easier to use. They have.

Both programs—Quicken 3 for Windows and Quicken 7 for DOS—advance the state of the art in personal finance management with one terrific innovation: a financial calendar interface. The idea is to use an ordinary calendar to schedule financial transactions, then use this information to chart cash flow. You can schedule both income and expenses on a one-time or recurring basis. Scheduled items are held in the calendar until they occur, at which time Quicken automatically enters them in the account register.

In the Windows version, scheduling transactions is a simple matter of drag-and-drop. Click on a payor or payee from the list of memoized transactions, then drag the transaction onto the appropriate date. You can create new transactions on the fly, too, either by dragging a "new" item onto the calendar or by clicking on the date to open a transaction dialog

box. This calendar likely will become your only interaction with an account register. Indeed, you never have to enter a conventional check at all, unless of course you prefer the check or register interface.

Unfortunately, the financial calendar in Quicken 7 for DOS isn't nearly as intuitive or flexible, since there's no drag-and-drop functionality. Nevertheless, you can highlight a date and select the "transactions" option to schedule a payment.

WHAT ELSE IS NEW

While the calendar is the most dramatic innovation in the new Quicken pair, both new versions boast a laundry list of improvements that enhance the convenience of what were already the most convenient financial man-

agement programs. In both versions, much of the improvement centers on the programs' investment tracking features. A new portfolio view neatly lays out investment performance so that you can see in one glance how you are doing. You can track investments by more than a dozen factors, including mar-

ket value and change, return on investment, dollars or percentage loss or gain, and estimated income. Price histories are maintained by Quicken so that you can analyze investments from a historical perspective. In Windows, these views are customizable, while the DOS version relies on preset reports for the most common performance measures.

QuickZoom, the ability to see the data from which reported numbers are derived, has been extended from the budgeting section of Quicken to the

those in other finance managers, including Managing Your Money, well-known for its investment management features.

Quicken's budgeting section lets you do much more analysis than previous versions so that you can better know how your money comes and goes, forecast cash flow, and set savings goals. So-called QuickReports are automatically generated from your check register, and most other reports have been expanded or are now customizable. Most reports include graphs so that you can see in pictures as

well as numbers how your financial life plays out.

A new pop-up calendar in the Windows version lets you quickly enter dates in the check register, and both versions have a pop-up calculator that can be used to enter data in the register's amount field.

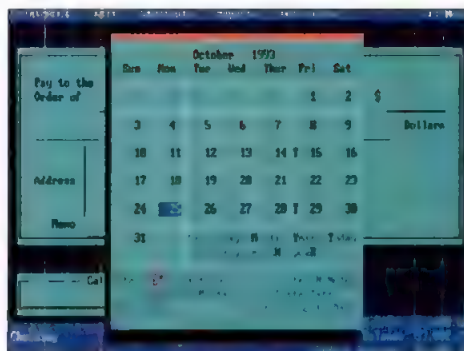
Add to all of

this context-sensitive Qcards, on-line tutors, and a well-written help system that you'll probably never need to use and the new Quicken programs blow away all other financial managers for simplicity, elegance, and completeness.

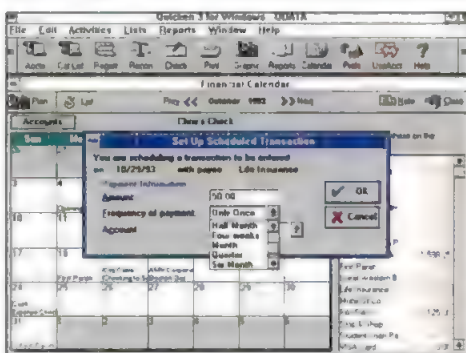
While both Quicken versions are excellent, Quicken for Windows has outstripped its DOS-based predecessor. We highly recommend the former for its completeness and convenience, unless you are a die-hard fan of character-based interfaces or your computer can't handle its modest demands.

● List price: *Quicken 7 for DOS*, *Quicken 3 for Windows*, \$69.95 each; upgrade \$29.95 plus \$5 shipping. Requires: *DOS version*: 640K RAM, DOS 3.0 or later. *Windows version*: 2MB RAM, Windows 3.1. Intuit Inc., 155 Linfield Ave., P.O. Box 3014, Menlo Park, CA 94026; 800-624-8742, 415-858-6095.

Circle 428 on reader service card



TEXT MODE: The DOS version has its own payment scheduling Calendar.



PAY DAY: Quicken's new Calendar feature schedules your transactions.

agement programs. In both versions, much of the improvement centers on the programs' investment tracking features.

A new portfolio view neatly lays out investment performance so that you can see in one glance how you are doing. You can track investments by more than a dozen factors, including mar-

ket value and change, return on investment, dollars or percentage loss or gain, and estimated income. Price histories are maintained by Quicken so that you can analyze investments from a historical perspective. In Windows, these views are customizable, while the DOS version relies on preset reports for the most common performance measures.

Investment tracking can be a confusing thing. Remarkably, Intuit has made this section of its finance managers as straightforward as its checkbook features. The program's Qcards coach you through data entry and teach a bit about investment management along the way. Screens are clean and well-organized, changing appropriately depending on the kind of data you must enter for a particular investment or transaction type.

To these improvements, Intuit added the ability for portfolios to handle deferred tax status accounts, such as 401(k) plans, and to manage the purchase and sale of securities from multiple lots. In combination, the portfolio capabilities of Quicken are now on par with

■ Multimedia

Picture Perfect Captures and Plays Full-Motion Video

BY ALFRED POOR

Video images on your computer screen can dress up anything from a word processing document to a multimedia presentation, thanks to Windows. In-Motion Technologies' new \$449 video capture and playback board, Picture Perfect, will help you use full-motion video, but it has a few shortcomings to watch out for.

Included software lets you view composite video signals on your screen (NTSC or PAL, but not S-Video) and configure the viewing window. You can also perform some rudimentary transformations on an image, freeze it, copy it to the Windows Clipboard, or save it in various Targa and .DIB formats. The package also includes Lenel Systems' MultiMedia Works, which helps you create multimedia presentations.

The half-length 16-bit ISA card doesn't have its own graphics adapter circuitry, so in order to use it you must have a VGA or SVGA card that includes a VGA pass-through connector.

Once you have the board installed and the drivers installed in Windows, you can view full-motion video on your Windows screen. You get full 24-bit color images, even if your Windows screen driver is set for 16 colors. In fact, according to In-Motion Technologies, you can't use a driver with more than 256 colors with the board. You may find this inconvenient, though, because it means you have to switch graphics drivers in order to edit captured stills with a high color depth.

The package we tested didn't include any way to record motion video, but In-Motion Technologies says that Microsoft Video for Windows will be bundled with future shipments.

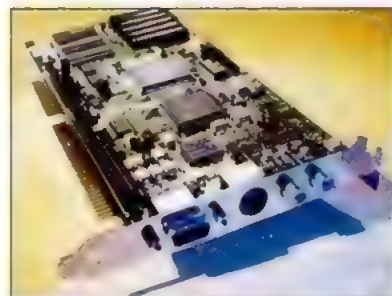
Using the Video for Windows VidCap program, you can record video in a number of formats, including 16-bit and 24-bit color, and using software-based JPEG image compression. Even with a 160-by-120 video window running on a 66-MHz 486DX2-based system, the package dropped dozens of frames when trying to record a 10-second clip at 15 frames per second.

Picture Perfect's strength lies in its good-quality 24-bit color even with a 16-color Windows driver, and in its high-quality frame captures. Its video connector is a handicap, however, and its thin documentation makes using the board a challenge. The promised bundling of Video for Windows will make the \$449 list price a relative bargain, but the board is still better suited for viewing video than for capturing it.

• List price: *Picture Perfect*, \$449. Requires: VGA or better graphics adapter

with VGA pass-through connector, Microsoft Windows 3.1. In-Motion Technologies Inc., 1940 Colony St., Mountain View, CA 94043; 415-968-6363; fax, 415-968-4488.

Circle 422 on reader service card



ADD-ON: Connect to your video board.

■ Utilities

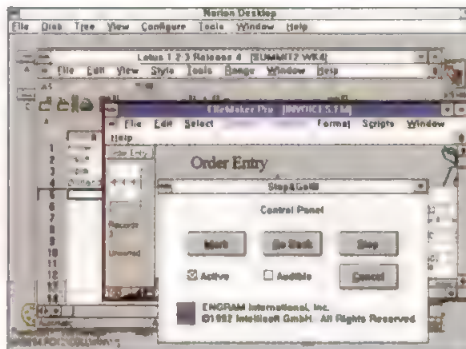
Save Complicated Windows Sessions with Stop & Go

BY CAROLE PATTON

Stop & Go, a new \$149.95 utility from Engram International, makes opening and closing complicated Windows desktops as easy as switching a TV on or off. There are, of course, a number of other utilities that speed up Windows exit and reentry, but most do it simply by storing the parameters of your Windows desktop. When you reboot, all your folders are open and ready, but not your running applications.

Stop & Go is more complete. It uses memory

You'll find that saving your session to disk takes up a lot of space, but things could be worse. Stop & Go has its own built-in real-time compression, which reduces the size of the required task file by about 50 percent. Otherwise, a 16MB system would need a 16MB task file.



HALT: One-button Windows shutdown.

imaging to record—in real time—the state of your system at the exact moment you shut down. This "picture" includes everything stored in RAM, everything in conventional, expanded, and extended memory, all register contents, and the settings of all your I/O ports. When you reboot, that picture (which is written to disk) is put back into memory.

Running the program is easy. You clicking on the Stop & Go icon to get to a control panel with buttons that let you save ("Mark") a session, return to an earlier version ("Go Back"), or shut down your computer ("Stop").

When we stopped our test system and then turned it back on, it took about 10 seconds to bring back our desktop, which

included Lotus 1-2-3, Release 4 for Windows; Microsoft Word for Windows; File Manager; and communications software.

Stop & Go itself must be loaded into conventional (not high) memory, because when restoring a memory image there is no such thing as upper memory. But when Stop & Go restores the memory image from the disk, it also restores any memory manager you run and anything that was loaded into high memory.

Stop & Go is also sold in a Card Kit that includes a self-charging nickel cadmium battery that serves to power the system and launch the software whenever a power loss occurs. Because the card sits between the power supply and the motherboard, it provides better DC overvoltage protection than a surge suppressor does. (A blown power supply is cheap to replace; a motherboard is not.)

The card kit offers even more convenience than the software alone. Once the card is installed, the power switch can be used to control Stop & Go.

• List price: *Stop & Go*, \$149.95 (introductory price, \$89.95); *Card Kit*, \$299.95. Requires: DOS 3.1 or later, Microsoft Windows 3.1. Engram International Inc., 625-E DuBois St., San Rafael, CA 94901; 415-455-1100; fax, 415-455-1111.

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What Lotus doesn't want you to know about new Quattro Pro 5.0

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1. "Experts" that do sophisticated tasks (like statistical analysis) for you
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3. Complete documentation available *online*
4. Improv-like crosstabs and data modeling tools *built in*
5. Built-in workgroup information sharing with any network or E-mail system
6. Analytical graphs to find trends in your data
7. Over 360 @functions—more than any other spreadsheet
8. Integrated user interface builder to make spreadsheet development easy
9. Complete slide show capabilities *built in*, including light table sorting
10. Database forms that let you manage data without having previous database experience

Lotus 1-2-3 R4

1. *Not!*
2. *Not!*
3. *Not!*
4. *Not!*
5. *Not!*
6. *Not!*
7. *Not!*
8. *Not!*
9. *Not!*
10. *Not!*

Shhhhhh! Lotus has a secret they don't want anyone to know. Quattro® Pro consistently ranks as the #1 spreadsheet in virtually every head-to-head comparison with both 1-2-3 and Excel. Take *PC Week's* September review where Quattro Pro beat 1-2-3 in four out of five categories. Or *PC Magazine's* annual customer satisfaction study where "Lotus lost the crown for overall satisfaction to both the DOS and Windows versions of Quattro Pro . . ."

Quattro Pro keeps winning because it has more power, more analysis tools, and is easier to learn and use. And now there are three brand new versions of Quattro Pro 5.0 (Windows, DOS, and Workgroup Edition) that are even better. The chart shows you how Quattro Pro's Workgroup Edition offers you built-in capabilities not found in Lotus 1-2-3 for Windows Release 4.

Now we'll let you in on *our* little secret. We want every Lotus user to try Quattro Pro, so we are making incredible introductory offers on all new versions of Quattro Pro. Sorry, Lotus, the secret is out.



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Desktop Publishing

FrameMaker 4: More Colorful, More Networkable

BY JAMES KARNEY

If you need to create long documents, FrameMaker 4 for Windows is built to go the distance. Like earlier versions, this \$895 package has all the power tools you need to create complex structured publications, and now it has a more intuitive user interface, better color control, and enhanced document management capabilities.

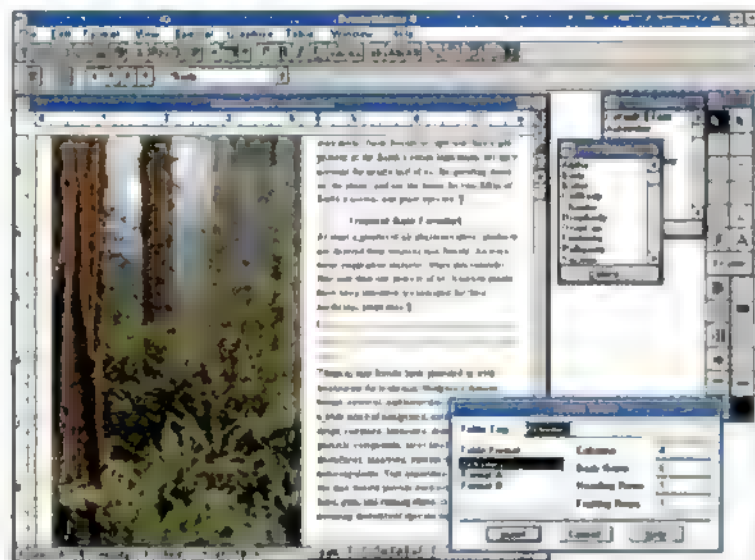
In the past, many users new to FrameMaker have found the program's deeply nested dialog boxes hard to master. Version 4 still uses the same tag/style sheet approach to formatting text, but the menus have been reworked. Dialog boxes are better, augmented with a word-processor-like button bar for executing many commands. You can use a new formatting ruler to access pop-up menus for line spacing, defining paragraph formats, setting tabs, and managing text alignment.

A nice touch is the ability to rotate and detach the button bar from underneath the menus. You can place it anywhere on the screen. Once you define a style, you can use it as the template for others. FrameMaker 4 made quick work of our test projects when we used one of its predefined templates and made modifications with the button bar.

If you don't like the new menus, the program's configuration files let you change them, and a C-based API (application programming interface) is available for building customized extensions to the product.

Frame Technology answered two complaints we made in our

last desktop publishing evaluation ("High-End DTP: The Changing of the Guard?" February 9, 1993) where Version 3.0 won an Editors' Choice. The new edition now supports network file-locking. You can open a read-only copy of a locked file, open an untitled copy for editing, and override a lock. FrameMaker's developers also beefed up color handling from a paltry 16 spot colors. It now supports four models: Red, Green, and Blue (RGB), CMYK (Cyan, Magenta, Yellow, and black), HLS (Hue, Lightness, and Saturation), and Pantone. FrameMaker can also produce four-color separations using a Post-



BOOK-LENGTH: FrameMaker is best at creating long documents.

Script-compatible printer.

Other new features include the ability to rotate both text and graphic elements in 0.001-degree increments; improved table, header, and footer editors; and new Page Design and Layout palettes.

Formatting equations is easy. To add an element you just click on the button labeled with the desired element, then replace any values denoted by the question-mark placeholders. Even

someone without mathematical training can duplicate complex forms using the WYSIWYG editor. Version 4 has better positioning controls and ability to handle multiline equations than older versions.

DOCUMENT MANAGEMENT

Another area of improvement is in document management. You can generate a detailed comparison between two documents, including a revision list showing all changes, along with a statistical summary that includes word count. The revised portions are joined by hypertext links that can be used for editorial navigation. When used with the condition text feature, this can be a handy tool for creating multiple versions of a publication.

FrameMaker provides exceptional on-line document support for a product in this price range. You can embed hypertext links and hypermedia objects in any file. FrameReader, an \$89 add-on, lets you view documents without having to use the main program. While Frame-

Reader won't let you edit documents, you can use it to print all or part of a document. Together with FrameMaker's ability to reference outside files, it provides all the tools needed to produce on-demand electronic publishing.

FrameMaker offers the best cross-platform support of any desktop publishing program. Files can be exchanged among Unix, Macintosh, and Windows platforms, and the interface is almost identical throughout. We loaded sample documents created in the Mac product without difficulty. The new Version 4 and older 3.0 files are also interchangeable. FrameMaker also supports a special version of the nCode language for marking up plain text files, which can be cre-

FACT FILE

FrameMaker 4 for Windows

Frame Technology Corp.,
1010 Rincon Circle,
San Jose, CA 95131;
800-843-7263, 408-433-3311;
fax, 408-433-1928

List price: \$895; upgrade, \$199.

Requires: 8MB RAM, 10MB hard disk space, Microsoft Windows 3.1.

In short: The much-improved FrameMaker 4 maintains its excellent cross-platform support while adding more networking features and far stronger color support.

427 ON READER SERVICE CARD

ated in any program that can export a plain ASCII file. The program can import most popular graphics and word-processing file formats including .EPS, Microsoft Word, .RTF, TIFF, Ventura Publisher, and WordPerfect. While it can handle CorelDRAW 3.0 files, we found it unable to recognize files in Corel's newer 4.0 format.

SOME ADVICE

There are some improvements we'd still like to see, including the ability to automatically wrap text around a graphic element and a more intuitive way to set the placement area for footnotes. Another plus would be more hotkeys for commonly used commands, a feature mostly absent in Version 4.

FrameMaker 4 for Windows is the most powerful PC-based collection of electronic publishing tools for handling long documents and cross-platform support. The redesigned user interface makes this version easier to use than its predecessor, and the new color-handling tools are a welcome improvement. While it lacks some of the WYSIWYG features we might like to see for handling very design-intensive projects, anyone who produces technical or other types of structured publications will find this product a real workhorse. □

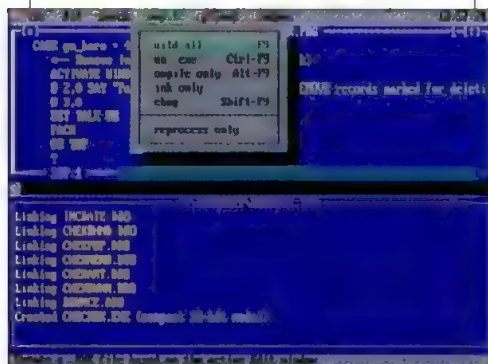
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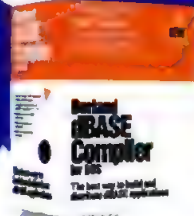
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■ Scanners

Caere's \$449 OmniScan Includes Scanner, Software

BY STAN MIASTKOWSKI

Hand scanners are becoming useful, comparatively inexpensive, and often essential tools for transforming graphics and printed text into computer-readable form. But getting the most from them requires software that all too often is an optional, expensive extra. With OmniScan, Caere has packaged its latest and greatest gray-scale scanner with virtually all the software you need for editing and manipulating scanned graphics images, performing optical character recognition on scanned-in text, and sending/receiving faxes. OmniScan's \$449 price tag represents a substantial savings over purchasing the individual pieces.

The heart of OmniScan is the scanner itself, the newest incarnation of Caere's Typist 256-shade gray-scale scanner. It scans a 4-inch-wide path and has resolutions of 100, 200, 300, and 400 dpi that you set with a slide switch located on the side

of the scanner head.

Unlike the truly portable parallel port scanners that are becoming available, the OmniScan is designed for permanent installation. It uses a standard 16-bit ISA add-in card. And because the card uses an I/O port, a DMA channel, and an



LIGHT THE WAY: OmniScan has OCR.

interrupt, it can take some time to install. If the default settings don't work (and they didn't in the loaded PC we tested OmniScan with), you'll have to deal with jumpers and DIP switches. On some systems, it can be a frustrating experience, although the OmniScan manual has some excellent tips for isolating conflicts.

Installing the Windows soft-

ware is a lot more straightforward. All the software is contained on three packed floppy disks. Clicking on the OmniScan icon brings up a simple but effective dialog box that wraps all the software in a central interface. Your choices are Scan Text, Scan Image, Send Fax, and View Fax. (The fax options drop out if you don't have a fax modem.)

Caere products aren't compliant with the industry-standard Twain specification, but because OmniScan is designed as an integrated package, that doesn't create a big problem. Common Windows packages are automatically registered by the scanner software, giving you an "OmniScan" option on your File menu (instead of the "Acquire" option for Twain-compliant products).

THREE PROGRAMS INCLUDED

Clicking on the Scan Text icon takes you directly into Caere's OmniPage Direct, a well-respected OCR package that was the first to work with hand scanners. Caere and its archrival in the OCR business, Calera, have kept pushing OCR technology ahead. OmniPage Direct lacks the bells and whistles—such as a good spell-checker and custom character recognition—of OmniPage Professional, the

high-end version. But the core technology is the same, and it delivers on its claimed 98 percent accuracy. Like all the applications in OmniScan, full-page text (or images) are automatically stitched together.

For scanning in images, OmniScan uses Image Assistant GS, the gray-scale-only version of Caere's image-editing package. Optimized for monochrome images, Image Assistant GS has a complete set of graphics tools.

Finally, there's FaxMaster, which supports the full range of fax modems including Class 1, Class 2, and CAS-based units, such as Intel SatisFAXtion mo-

FACT FILE

OmniScan

Caere Corp., 100 Cooper Ct.,
Los Gatos, CA 95030; 800-
535-7226, 408-395-7000; fax,
408-354-2743.

List price: \$449

Requires: 4MB RAM (8MB recommended), 8MB hard disk space, Microsoft Windows 3.1, 16-bit add-in slot, fax/modem for FaxMaster

In short: A 256-shade, 400-dpi handheld scanner that stands apart from the pack for its low price and for its integration of a full set of software tools.

ON READER SERVICE CARD

dem. FaxMaster has all the features of its many competitors, along with a couple of notable extras. It interfaces directly to OmniPage Direct for OCR, but even more singular is Caere's SuperCompression. As the name implies, it shrinks the size of fax files, which can gulp huge amounts of hard disk space, at an average 33:1 ratio.

At \$449, OmniScan is an excellent deal, especially since you can use the fax, OCR, and image-editing packages independently of the scanner. Taken individually, they're eminently useful, even though the OCR and image-editing packages lack features found in high-end packages. OmniScan's real power lies in the integration of the hardware and software. □

■ Making Hand Scanning Easier

Face it, dealing with a hand scanner will never be as convenient as using a full-fledged flatbed scanner. But despite the fact that full-size scanner prices have been falling, hand-scanner packages like OmniScan are still an attractive and economical alternative for getting your paper-based data into your PC.

One thing that's made the hand-scanning process less of a hassle is that scanner makers have been spending a lot more time making the

gadgets easier to use. Even though it has a traditional "clamshell" design, the OmniScan is easy to keep straight and steady. That's because Caere uses several widely separated rollers on the scanner.

Scanning, however, is still a relatively slow process. We got the best results by pulling the scanner steadily at about an inch a second. If you scan too fast, OmniScan beeps and a warning LED lights.—SM

A group of five children, all wearing yellow hard hats, are standing on the curved, yellow surface of a large, boat-like structure. The structure is illuminated from above, creating a bright yellow glow. The background is dark, and the overall scene suggests a playful or educational activity.

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Databases

Q&A for Windows: DAVE Will Help You Build Queries

BY RICH MALLOY

It's been a long time coming, but Symantec Corp. has finally released the Windows version of one of its most important products, the venerable Q&A database/word processor. Like its DOS-based predecessor, the new \$249 Q&A 4.0 for Windows should appeal to users who want a simple but proficient database with good mail-merge capabilities and an impressive querying tool.

The DOS version of Q&A was successful because it gave business users a unique combination of a full-featured (though flat-file) database manager with a full-featured word processor. The icing on the cake was the Intelligent Assistant, a novel querying tool—the first and still the most successful natural-language-recognition technology on the market.

Q&A for Windows continues in the DOS version's footsteps. Its foundation is a good, easy-to-use flat-file database updated with most of the usual Windows buttons and bitmaps. You'll have little trouble getting a database up and running. One glitch we encountered—consistent crashes when we tried to preview a printed report—was troublesome, however.

The program's new ease-of-use features include a well-designed, flexible spreadsheet option that lets you view and edit data fairly easily. There's also a quick report generator that produces straightforward layouts that are relatively simple to enhance. A Mass Update tool provides a much-needed search-and-replace facility for flat-file

BUTTONS AND BITMAPS: Q&A lets you spruce up data entry forms.

databases. And a Ditto option can handle repetitive data fields and save a lot of time in data entry.

HIGH-END FEATURES

Despite its ease of use and its flat-file organization, the product doesn't stint on high-end features. The new Q&A is network-ready, with a good assortment of security clearance options. It will read and write most of the major database file formats, and it can implement lookup tables either as external databases or as an internal table that can be subdivided into several smaller tables. The program can print to a full complement of Avery label formats.

Interoperability between Windows and DOS systems may be a key reason to choose Q&A over other databases. The new version will read old Q&A DOS files, and the most recent DOS version (4.0) can work with files created by the Windows version—but only if it has been

updated with a compatibility disk (\$5 plus \$8 shipping).

Bundled in Q&A for Windows is Q&A Write, which debuted as a standalone word processor earlier this year. It's a fairly capable product that will satisfy the simple needs of most users, but it certainly won't win any feature wars with the likes of Microsoft Word for Windows, Ami Pro, or WordPerfect.

stored earlier in Q&A or create a new spec on the spot. It's also easy to print envelopes for mail-merge documents, a weakness in many other word processors.

HUMANOID HELPER

The extra bonus in Q&A is still its Intelligent Assistant. Now nicknamed DAVE (for *Do Anything Very Easily*), this innovative tool has metamorphosed into a more prosaic querying facility. The new Intelligent Assistant can no longer parse English sentences. Instead, it helps you build an English-like request by choosing terms from successive menus of syntactically correct choices. What this approach lacks in gee-whiz technical wizardry it makes up for in functionality, since it guarantees that IA will understand what you want.

IA works. After only a brief glance at the manual we were able to generate a complex report—listing the average salaries of a group of employees broken down by job classification and sex—in just 30 seconds.

Recognizing a good thing, Symantec has used this same mechanism to help you build scripts as well as queries. Once a script is built, it can be easily attached to a button.

What's missing in Q&A for Windows? We would have liked to see more symbiosis between the database and the word processor. For example, FileMaker Pro has a spell-checker, but Q&A, even though it resides in the same subdirectory as Q&A Write, cannot use that product's spell-checker.

Can a flat-file database make it in a world of database wars where you can get almost anything you want for \$99? In a word, yes, as Claris Corp.'s FileMaker Pro for Windows has ably shown. True, if you want to build a powerful and intellectually interesting database, buy Approach, Paradox, or Access. But if you want to get a job done, and the job happens to include some data that needs sorting, take a look at Q&A. □

FACT FILE

**Q&A 4.0
for Windows**

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014;
800-554-4403, 408-252-3570

List price: \$249.95; upgrade, \$89.95;
Requires: 4MB RAM, 17MB hard disk space, Windows 3.1.
In short: Q&A finally arrives in Windows with the ease of use and Intelligent Assistant that made earlier DOS versions popular.

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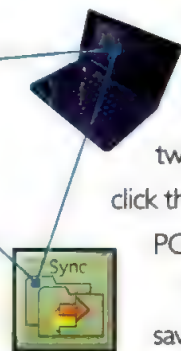
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The Autobahn, Germany

P3 will be used to rebuild the Autobahn in what was formerly

East Germany. Both contractors and subcontractors are standardizing on Primavera for this project



New Hong Kong Airport, Hong Kong

This \$20 billion airport construction project also includes the construction of highways, an airport rail system, a suspension bridge and a cable stay bridge. Projected completion is June 1997



Kuala Lumpur Tower, Malaysia

This \$100 million, 420-meter tower will be the third tallest communication tower in the world. Estimated completion date is 1996



The Georgia Dome, USA

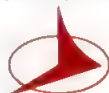
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New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Brad Grimes

NEW

DOS Users Need No Longer Covet After Dark for Windows

Staunch DOS users who haven't known the pleasures of **Berkeley Systems'** popular After Dark screen-saver programs can now look forward to having flying toasters grace their screens too, thanks to After Dark for DOS, Version 1.0. It's a bit of a reverse progression—a DOS version coming out *after* its Windows counterpart—but After Dark is still full-featured, with more than 30 screen savers to choose from, support for Ad Lib- and Sound Blaster-compatible sound cards, and SystemIQ for monitoring the system's activity and maximizing its performance under After Dark. After Dark for DOS requires DOS 3.3 or later, a VGA or SVGA display, 640K of RAM, and 2MB of hard disk space. Take note, though: After Dark for DOS won't run under Windows.

• List price: *After Dark for DOS, Version 1.0*, \$49.95. Berkeley Systems Inc., 2095 Rose St., Berkeley, CA 94709; 800-877-5535, 510-540-5535; fax, 510-540-5115.

Circle 406 on reader service card

NEW

Xerox Ships Ink Jet Printer

Xerox Corp. is bringing its brand of printing to a personal level. The vendor of high-end printing systems has introduced the Xerox 4004 Personal Printer, a 300-dpi ink jet design that uses a nozzle with 128 jets to print at a speedy 300 characters per second. It emulates the HP DeskJet 500 printer family and has two card slots for optional memory and font upgrades. Resident typefaces include Courier, and Letter Gothic. The 4004 comes with X-traProtection: free 48-hour replacement service, toll-free support, and a limited three-year warranty.

• List price: *Xerox 4004 Personal Printer*, \$299. Xerox Corp., 100 S. Clinton Ave., Rochester, NY 14644; 800-832-6979, ext. 4004.

Circle 407 on reader service card

HOT
PROSPECT



Insignia's New Unix Offering: A Better Windows than Windows?

Insignia Solutions, a leader in cross-platform compatibility solutions, is making sure you can run *all* DOS and Windows applications on a Unix-based system without giving up performance. SoftWindows for Unix includes Microsoft DOS and Windows code that's been optimized by Insignia to deliver 486-like performance to DOS and Windows apps on the Unix platform. An advantage SoftWindows for Unix has over SunSelect's WABI is the license from Microsoft to include current and future code. This ensures compatibility for all DOS and Windows programs through Windows 4.0 ("Chicago").

SoftWindows is also compatible with the entire PC environment, including COM and LPT ports, floppy disk drives, memory systems, video displays, networks, and CD-ROM drives. It supports advanced Windows features like DDE and OLE, as well as simple functions like cut, copy, and paste. While it doesn't have the look and feel of Motif, it will in future releases. It will also support 32-bit Windows applications.

The first versions of SoftWindows for Unix will be available late this year on HP and Sun Microsystems workstations. Versions for DEC, IBM, and SGI workstations will come out next spring.

• List price: *SoftWindows for Unix*, \$549. Insignia Solutions Inc., 1300 Charleston Rd., Mountain View, CA 94043; 800-848-7677, 415-694-7600; fax, 415-694-3705.

Circle 405 on reader service card.

NEW

Logitech Ships Mouse for Advanced 3-D Applications

Logitech's new Space Control Mouse is a super mouse targeted at users of 3-D CAD, 3-D modeling, and virtual reality. The control device is a spring-mounted puck that you squeeze and maneuver to navigate through three dimensions on-screen and to provide functions like Pan, Roll, and Zoom to your PC applications. Nine mouse buttons can be programmed to pan and zoom, to change to standard



A mouse for all dimensions.

2-D operation, and more. The Space Control Mouse attaches to a serial port and comes with drivers for PCs, as well as for HP and Silicon Graphics workstations.

• List price: *Space Control Mouse*, \$999; Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 510-795-8500; fax, 510-792-8901. Circle 408 on reader service card

NEW & IMPROVED

WindowMagic Gets Stronger And Hits the Retail Market

What was already a strong shareware program is now an even stronger retail product. **Win-Wear** has added a series of utilities to WindowMagic, Version 2.0, its Program Manager enhancement tool (see First Looks, October 26, 1993, for an evaluation of the shareware version). Version 2.0 includes X-It Wear, which lets you exit, reboot, or restart Windows from any application; adds restart and reboot options to the Windows Exit dialog box; and features Print-It Wear, which lets you drag and drop documents for printing, as well as assign commonly printed documents to a hotkey for quick printing.

With WindowMagic you can create your own free-floating toolbars, and you can quickly start applications from minimized Program Manager groups or WindowMagic toolbars using QuickAccess and FastLaunch. To further

New & Improved

customize your desktop, WindowMagic has drag-and-drop icon management tools that let you choose icons from a library of thousands.

• List price: *WindowMagic, Version 2.0*, \$79.95 (\$49.95 for a limited time). WinWear, 14150 NE 20th St., #346, Bellevue, WA 98007; 800-879-7899, 206-882-1530; fax, 206-557-8324. Circle 409 on reader service card

NEW

Handwriter for Windows Brings Pen Computing to Desktop PCs

For a breakthrough price of \$199, **Communication Intelligence Corp. (CIC)** delivers pen computing to you at your desktop PC, complete with both hardware and software. Handwriter for Windows combines a cordless pen and a thin tablet with an extensive collection of pen software, including CIC's own Handwriter Recognition System, Microsoft Pen Extension for Windows, and a variety of utilities. The Handwriter screen saver uses CIC's Dynamic Signature Verification software, requiring your signature rather than a password to unlock the screen. Once you've plugged the tablet into the serial port of your PC and loaded the software, you can use the cordless pen instead of a mouse for controlling Windows applications. With Pen Extensions you can create your own pen-based macros.

• List price: *Handwriter for Windows*, \$350 (\$199 for a limited time). Communication Intelligence Corp., 275 Shoreline Dr., Redwood Shores, CA 94065; 800-888-9242, 415-802-7888; fax, 415-802-7777.

Circle 410 on reader service card

NEW

With Innova, Canon Makes Its Presence Felt in the PC Market

We know they make great printers, but will **Canon Computer Systems'** new Intel 486-based line of Innova notebook and desktop PCs earn Canon a reputation for building great computers? The technology is definitely in line with today's standards. The three Innova notebooks (monochrome, dual-scan color, and active-matrix color) have large, built-in trackballs, ergonomic palm rests, 120MB hard disks, and slim 2-inch-high cases. The active-matrix Innova 486TX also has two Type II PCMCIA slots.

The Innova desktop systems range in processor type from 486SX/25 to 486DX2/66, and they're all upgradable to a Pentium processor. They have VESA local-bus graphics, 170MB or

BRIEFS SOFTWARE

Not putting all its eggs in the disk compression basket, **Addstar** has announced *Organize Your Way*, Version 4.0 (\$99), a personal information manager that the disk compression vendor is marketing through an agreement with Prisma Software. *Organize Your Way* has a database, a calendar, a to-do list, and a contact manager. Version 4.0 adds a yearly planner, drag-and-drop scheduling, and the ability to merge contact databases. 415-688-0470.

The Baarns Consulting Group is shipping *The Baarns Utilities*, Version 2.0 (\$89.95), an add-in program for Microsoft Excel that integrates 23 utility programs into Excel. These appear on-screen as a separate toolbar of icons. Nine utilities new to Version 2.0 include Baarns File Express, which lets you create groups of files that can all be opened at once; Baarns Path Manager, which lets you replace long path names with descriptive phrases; and Baarns Save Now, which automatically saves your current spreadsheet at specified intervals. 800-377-9235, 818-364-6148.

Bitstream has announced that its entire typeface library—nearly 1,100 typefaces—will now be available in TrueType format. The TrueType version of the Bitstream Typeface Library (\$32.25) represents the first complete major digital type library in TrueType. 800-522-3668

Canyon Software has released Version 3.0 of its ZIP file manager, *Drag and Zip* (\$25). Using Windows and PKZIP you can zip, unzip, view, run, delete, or extract zipped files by clicking on *Drag and Zip's* tool buttons. New features include Check Out, which lets you temporarily extract zipped files for viewing; virus scanning of compressed files; and support for the LHA compression program and LHZ files. 415-382-7999.

IBM Corp. has announced Version 1.03 of its IBM AntiVirus/DOS and IBM AntiVirus/2 (\$29.95 each). Both IBM AntiVirus programs have automatic installation routines, graphical user

240MB hard disks, and 1MB of video memory. Higher-end models of Innova desktops also come with a 9,600-bps fax modem.

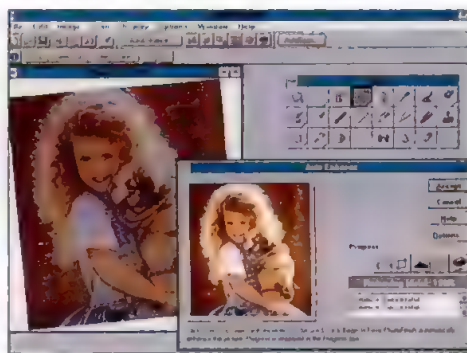
• List price: *Canon Innova 486*, \$1,397 to \$2,299 (desktop PC); \$1,799 to \$3,749 (notebook PC). Canon Computer Systems Inc., 2995 Redhill Ave., Costa Mesa, CA 92626; 800-848-4123, 714-438-3000; fax, 714-438-3099.

Circle 412 on reader service card

NEW & IMPROVED

WordStar Updates PhotoFinish, Markets New PC Paintbrush

WordStar International, which bought ZSoft last year, is shipping Version 3.0 of PhotoFinish, its photo enhancement program, and a new, full-featured version of the Windows Paintbrush accessory called PC Paintbrush for Windows. PhotoFinish 3.0 includes AutoEnhance, which scans, crops, straightens, sharpens, and enhances images in one step; Direct Scanner Support and Stitching, which lets you join two or more scanned images as one; and Filter Previews, which gives you samples of filters in a menu. PhotoFinish 3.0 has 87 paint tools and supports natural painting effects, such as crayons and watercolors.



PhotoFinish 3.0 includes an easy-to-access Auto Enhance utility.

PC Paintbrush for Windows is a souped-up retail version of what's been called a glorified Etch-A-Sketch—the Windows Paintbrush. This Paintbrush program, however, has Natural Paint Tools, which simulate oil paint, markers, chalk, charcoal, highlighters, and even the techniques of Seurat and Van Gogh. There are 87 additional painting tools and a variety of special effects such as Smear, Emboss, Mosaic, and Motion Blur.

• List price: *PC Paintbrush for Windows*, \$59.95; *PhotoFinish, Version 3.0*, \$149. WordStar International Inc., 201 Alameda Del Prado, Novato, CA 94949; 800-426-8855, 415-382-8000; fax, 415-382-4952.

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would this bozo
think I’d want
to buy a 1993
Pentium with a
bus that’s been
dragging its butt
since 1984.”*

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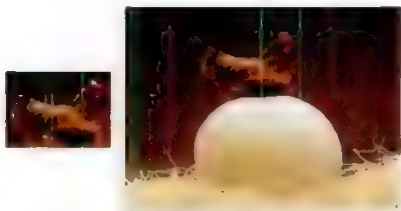
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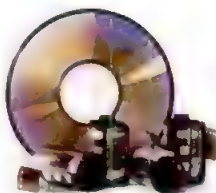
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- MS-DOS 6.0/Microsoft Windows 3.1/Mouse

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INTRODUCING THE

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than talk to one of those techno-
wannabees who think a bus is some
form of public transportation"*

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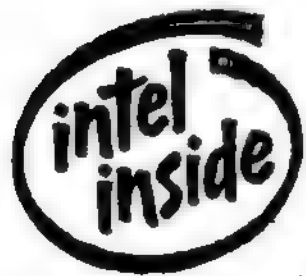


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- 4MB RAM • 64MB Max RAM • 270MB Hard Drive • Upgradeable to Pentium Overdrive™ • 5 16-Bit ISA Expansion Slots Available, 2 on VL-BUS™ • Accelerated Local Bus Video • 512KB Video RAM • UltraScan™ 14C Monitor (14" 1024 x 768, .28mm, NI) • One Diskette Drive (3.5") • Spacesaver Keyboard • MS-DOS® 6.0/ Microsoft® Windows™ 3.1/Mouse

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i486 DX 33MHz SYSTEM

\$1,799

Business Lease: \$67/MO.

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DELL DIMENSION 466V
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\$1,999

Business Lease: \$74/MO.

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\$2,499

Business Lease: \$92/MO.

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DELL DIMENSION XPS 466V
i486 DX2 66MHz SYSTEM

\$2,699

Business Lease: \$100/MO.

- 8MB RAM • 64MB Max RAM • 528MB Hard Drive • 256KB External Cache • Upgradeable to Pentium Overdrive • 6 16-Bit ISA Expansion Slots Available, 1 on VL-BUS • VL #9GXE Video Accelerator Card with Video Control Panel Software • 1MB Video RAM • UltraScan 15FS Monitor (15" 1024 x 768, .28mm, NI) • One Diskette Drive (3.5") • Spacesaver Keyboard • MS-DOS 6.0/ Microsoft Windows 3.1/Mouse

DELL DIMENSION XPS 466V
i486 DX2 66MHz SYSTEM

\$2,999

Business Lease: \$111/MO.

- 16MB RAM • 64MB Max RAM • 450MB Hard Drive • 256KB External Cache • Upgradeable to Pentium Overdrive • 5 16-Bit ISA Expansion Slots Available, 1 on VL-BUS • VL #9GXE Video Accelerator Card with Video Control Panel Software • 1MB Video RAM • UltraScan 15FS Monitor (15" 1024 x 768, .28mm, NI) • One Diskette Drive (3.5") • Spacesaver Keyboard • Multi-Session, Double-Spin CD ROM Drive • MS-DOS 6.0/ Microsoft Windows 3.1/Mouse

DELL DIMENSION XPS P60
PENTIUM 60MHz SYSTEM

\$3,999

Business Lease: \$144/MO.

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TOY BOX

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- Peavey 220 Stereo Speakers

MULTIMEDIA UPGRADE: \$398

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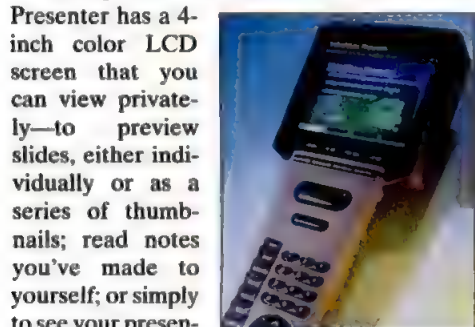
IN CANADA: CALL 800-668-3021. PLEASE REFERENCE #11BJR

New & Improved

NEW

VideoShow Presenter: Remote Control with a Built-In Screen

VideoShow Presenter, from **General Parametrics Corp.**, is an innovative hand-held remote-control device that works with presentation graphics programs like Harvard Graphics, Lotus Freelance, and Microsoft PowerPoint. Besides providing buttons to control the presentation itself, the VideoShow Presenter has a 4-inch color LCD screen that you can view privately—to preview slides, either individually or as a series of thumbnails; read notes you've made to yourself; or simply to see your presentation as it progresses and keep your attention focused on your audience. The VideoPresenter plugs into the parallel port of your notebook or desktop PC and weighs about 1 pound.



A remote control with a view.

• List price: *VideoShow Presenter*, \$1,649. General Parametrics Corp., 1250 Ninth St., Berkeley, CA 94710; 800-223-0999, 510-524-1530; fax, 206-557-8324.

Circle 409 on reader service card

IMPROVED

Infinite Disk Takes Disk Compression a Step Further

Not only does **Chili Pepper Software's** Windows-based Infinite Disk, Version 2.0, compress files to free up more disk space, it organizes files in a hierarchical system based on how frequently you use them. Level 0 is for the data and program files you use most often; Level 1, for inactive files, compresses at an average ratio of 2:1; and Level 2 is for files that are rarely or never used. Level 2 files are automatically moved to another storage medium like a floppy disk, a removable hard disk, or a floptical drive (support for QIC-80 is in the works). All the files appear to be on your hard disk. Infinite Disk's own file manager lets you know the exact status of the files. You can schedule Infinite Disk to archive and compress files, and you can view an analysis of your storage hierarchy in several charts and graphs.

• List price: *Infinite Disk, Version 2.0*. Chili Pep-

BRIEFS

SOFTWARE

interfaces, and advanced virus detection and removal technologies that include fuzzy checking, heuristic analysis, and false-alarm elimination. Both versions come in full-featured LAN editions. IBM offers site licenses that literally reduce the cost of using IBM Anti-Virus to a few dollars per system. 800-551-3579 (single copies), 800-742-2493 (site licenses).

VIEW Software has unveiled QuickFind, Version 1.01 (\$49.95), an easy-to-use document manager for Microsoft Word for Windows 2.0 and Microsoft Excel 4.0 files. QuickFind lets you create file and directory names up to 255 characters long. It is integrated with the applications under the File Open and the File Save As commands, and comes with the QuickFind Manager for managing files using their long file names. QuickFind is also compatible with any network that runs under Windows. 800-487-8439, 415-856-8439.

Zebra Express has introduced its namesake accounting program, Zebra Express for Windows (\$99 for a limited time), which comes with modules including Accounts Payable, Accounts Receivable, Fixed Assets, General Ledger, and Inventory Control. You have the option to install separate security features on each module in a network installation. 800-401-0060.

PCs

Gateway 2000 has announced the first Pentium-based PC to feature PCI local-bus architecture. The Gateway P5-60 (\$3,595) uses ATI's new Ultra XLR PCI video card with 2MB of DRAM. It comes standard with 16MB of RAM, a 424MB hard disk, 256K of secondary cache, and a double-speed CD-ROM drive. Four ISA, two PCI, and one PCI/ISA slot fit into the P5-60's tower case.

Gateway's line of mini desktop PCs now includes a 50-MHz 486DX2 and a 66-MHz 486DX2 model. The 4DX2-50 and 4DX2-66 (\$1,795 and \$1,995, respectively) come standard with 4MB of RAM, a 340MB hard disk, and 128K of secondary cache, plus a local-bus graphics accelerator with 1MB of DRAM. 800-846-2000, 605-232-2000.

per Software, 1630 Pleasant Hill Rd., #180-200, Atlanta, GA 30136-5827; 800-395-1812, 404-339-1812; fax, 404-513-7411.

Circle 413 on reader service card

NEW

For a Few Bucks You Can Work On Your Taxes Year-Round

ChipSoft's two new low-cost tax programs will help you with your taxes before the head-start edition of your tax preparation software arrives, and long before the final version is complete. Whether you use tax software or not, the TurboTax Tax Savings Guide is an interactive source of over 250 tax-savings tips. The TurboTax Tax Planner, available in DOS and Windows versions, analyzes your finances and estimates your tax liability. It incorporates President Clinton's new tax laws and features adjustable tax rates and brackets so you can accurately plan for 1993 taxes and flexibly plan through 1997. The Tax Planner allows for five different scenarios per year, and it will import data from programs like Quicken and Managing Your Money.

• List price: *TurboTax Tax Planner*, \$29.95; *TurboTax Tax Savings Guide*, \$19.95. ChipSoft Inc., Personal Order Dept., 2650 E. Elvira Rd., #100, Tucson, AZ 85706; 800-964-1040; fax, 800-756-1040.

Circle 414 on reader service card

IMPROVED

Jurisoft's Redlining Software Supports Both DOS and Windows

It's not just for lawyers anymore! **Jurisoft's** CompareRite, Version 5.0, redlining software supports word processors under both DOS and Windows. CompareRite 5.0 will compare two versions of a document written in the same or in two different word processors, and then highlight changes in a user-defined mode as well as create a revision report describing those changes. You can view additions and deletions side by side, see text that has been moved, and compare footnotes. Although CompareRite is no longer just a program for WordPerfect shops, users of WordPerfect 5.1 or earlier can use Jurisoft's DirectConnect for accessing CompareRite features from within the word processors.

• List price: *CompareRite, Version 5.0*, \$189 (\$50 to upgrade). Jurisoft, 955 Massachusetts Ave., Cambridge, MA 02139; 800-752-2640, 617-864-6151; fax, 617-661-0630.

Circle 416 on reader service card

NEW

Proxima Desktop Projector Challenges Projection Panels

Proxima Corp. claims to have found a new category of PC peripheral. Now, instead of putting a projection panel on top of a bulky overhead projector whenever you want to make a presentation from your PC, you can hook up to the self-contained Proxima Desktop Projector. The 18-pound Desktop Projector has its light source, mirrors, and display panel built into one ergonomically designed unit. The Proxima's compact size and portability are made possible by its patent-pending "folded" optical design and angled panel placement, which allow the lens to be stored within the body of the projector. All you do is flip open the front panel and the mirror pops into place. Connect the Projector to your PC and you're ready to go.

There are three models. The \$8,995 Model 2800 is a multimedia projector with an active-matrix display and a digital video processor; the \$7,995 Model 2700 has an active-matrix display with optional audio and video support; and the \$4,995 Model 2300 is a passive-matrix version. All three come with Proxima's Presentation Control software and the Cyclops pointer system for remote control. This lets you program the unit's remote control to move the presentation forward or backward or to pause, pacing your presentation much as you would if you were using a slide-carousel system.

• List price: *Proxima Desktop Projector*, \$4,995 to \$8,995; *Proxima Corp.*, 6610 Nancy Ridge Dr., San Diego, CA 92121-3297; 800-447-7694, 619-457-5500; fax, 619-457-9647. Circle 417 on reader service card

NEW

Multimedia Gets New Sound from Two Labtec Speaker Systems

With multimedia popping up everywhere, it's time to pay attention to the speakers you use. **Labtec Enterprises**, whose speakers you probably know but whose name you may not, has announced two speaker systems that should be making their way into multimedia kits soon. The Labtec CS-900 is a two-way, 7-watt system with separate on/off switches and treble boost, and separate slide controls for volume and bass. The higher-end Labtec CS-1400 is a two-way, 15-watt design with bass, treble, and volume dials.

It also features a magnetically shielded design, a 3-inch rolled-edge woofer, 2-inch alni-

BRIEFS

PCs

Leading Edge Products has introduced systems to its WinPro 486 Series of multimedia and desktop PCs based on a 33-MHz 486SLC processor. The desktop systems range in price from \$899 for 2MB of RAM and a 120MB hard disk, to \$1,139 for 4MB of RAM and a 213MB hard disk. The two multimedia systems, each with a Sony CD-ROM drive, a Sound Blaster Pro sound card, and stereo speakers list for \$1,249 and \$1,399, respectively. The latter version includes a 2,400-bps modem. 800-874-3340, 508-836-4800.

NEC Technologies has brought Energy Star compliance to its PowerMate and Ready lines of PCs. The PowerMate 486es Series (\$879 to \$1,619) and the Ready 486es Series (\$999 to \$1,899) both feature a sleep mode that powers the PC down to less than 30 watts after a user-defined period of inactivity. The PowerMate Series is aimed at entry-level users, while the Ready Series, with its local bus video architecture, is aimed at users in small offices and home offices. 800-388-8888, 508-264-8000

Toshiba is shipping a new family of Satellite notebook PCs based on an Intel 40-MHz 486DX2 processor. The Satellite T1950 series (\$2,199 to \$3,249) includes monochrome, dual-scan color, and active-matrix color models with 4MB of RAM, a 120MB or 200MB hard disk, one PCMCIA 2.01-compliant slot, and a Microsoft BallPoint Mouse 2.0 with QuickPort connection. 800-334-3445.

Zenith Data Systems has announced yet another line of notebook PCs, called the Z-STAR 433VL series (\$1,399 to \$2,399). Each unit is based on a 33-MHz 486SLC processor and comes with either a monochrome display or a DualBrite display. DualBrite is ZDS's version of enhanced passive-matrix color technology. Z-STAR notebooks come with 2MB or 4MB of RAM, an 80MB, 170MB, or 200MB hard disk, a Type II PCMCIA slot, and a J-Mouse pointing device that is integrated into the keyboard. 800-553-0331.

co tweeters, and two-line inputs for secondary source applications. Both units have headphone input jacks and an AC/DC power supply. In each case, speaker controls are located on just one of the two speakers for ease of use.

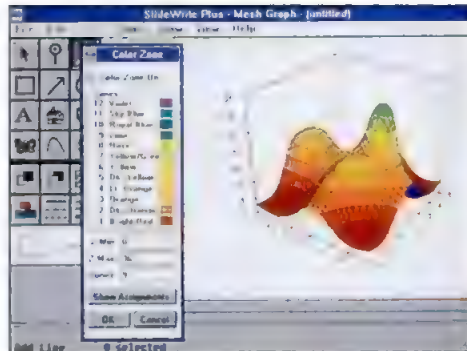
• List price: *Labtec CS-900*, \$99.95; *Labtec CS-1400*, \$149.99. *Labtec Enterprises*, 11010 NE 37th Circle, #110, Vancouver, WA 98682; 206-896-2000; fax, 206-896-2020.

Circle 418 on reader service card

IMPROVED

AGS Adds 3-D Graphing, Curve Fitting to SlideWrite Plus

Advanced Graphics Software has introduced Version 2.0 of SlideWrite Plus for Windows, its technical graphing and presentation software program, which features advanced 3-D graphing and curve-fitting capabilities. Twenty data series, with 32,000 data points each, can be plotted and displayed in 3-D bar, ribbon, or area graphs under SlideWrite Plus 2.0, and trends in data can be identified with user-defined colors. Through the program's Math menu, you can perform 2-D or 3-D linear or nonlinear curve fitting.



AGS's SlideWrite Plus, Version 2.0, is technical graphing with a friendlier face.

"Learning the language" is no longer a requirement when curve-fitting with Version 2.0. The process is now entirely menu-driven. SlideWrite Plus 2.0 supports DDE for linking data points in spreadsheet programs; it also exports graphs in formats like .EPS, .PCX, and TIFF. SlideWrite Plus 2.0 also supports TrueType fonts and has eight specially designed TrueType fonts of its own.

• List price: *SlideWrite Plus for Windows, Version 2.0*, \$445 (\$129 to upgrade from Windows version, \$149 to upgrade from DOS version). *Advanced Graphics Software Inc.*, 5825 Avenida Encinas, #105, Carlsbad, CA 92008; 619-931-1919; fax, 619-931-9313.

Circle 419 on reader service card

Look Who's In Our Corner.

**AMD® Is Pleased To Point Out That Our x86 Microprocessors
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Down at the bottom and over to the right. You can't miss it.



Right there in the corner of every AMD x86 microprocessor is a logo that says our CPUs are 100% Microsoft Windows-compatible.

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**Advanced
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Windows-compatible logo in the corner of AMD microprocessors.

For more details, call AMD.

800-292-9263



Advanced Micro Devices

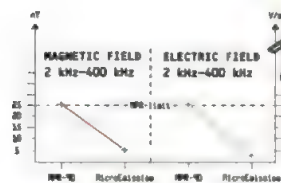
OUR MONITORS LAST SO LONG, WE'VE HAD TO EXTEND THE LIVES OF OUR CUSTOMERS.

True, nobody's drawn a direct connection between video display emissions and longevity. But people are worried enough to have government-set limits on them. The strictest limits come from Scandinavia. So do the monitors that cut these emissions so low they can't even be measured: Nokia.

Nokia monitors with MicroEmission® far surpass even TCO*—the toughest emissions standards in the world—with bonded display panels and full metal encasement.

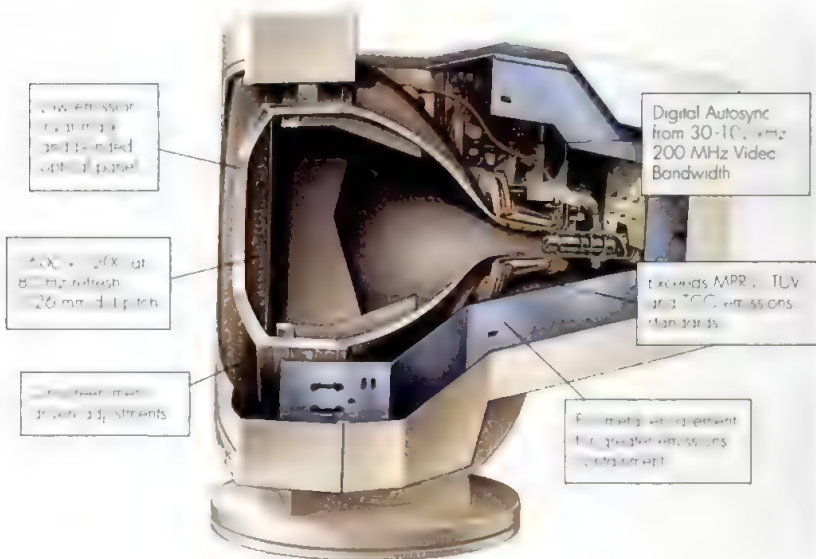
Fine. But what does that leave you to look at?

Well, Nokia MultiGraph® series monitors are arguably the most vivid in the world. In fact, the vast 21" unit achieves a



Nokia MicroEmission greatly reduces magnetic and electrical fields exposure below the current Swedish MPR-90 standards.

1600 x 1200 display at a remarkable 80 Hz refresh rate with 0.26 mm dot pitch. In other words: Huge, clear and absolutely flicker-free.



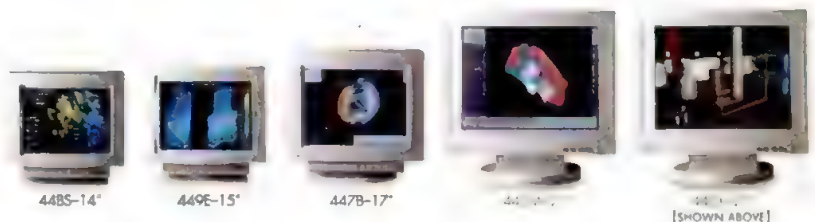
The unique FullScreen® feature eliminates the dead border without edge distortion. The picture can be adjusted not just horizontally and vertically, but also trapezoidally and orthogonally. More impressively, the DigiControl™ on-screen menu-driven display adjustment can memorize your workstyle preferences (which is faster, easier, and far more precise than reaching for knobs hidden in the back

somewhere.) And Nokia monitors offer user-defined PowerSaver™ which further reduces those wicked emissions. It also saves the tube and helps the whole unit last longer.

Before you buy your next monitor, look into a Nokia. It could be the decision of a lifetime. Call 1.800.BY NOKIA, Dept. E5 for the dealer nearest you.

NOKIA

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Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Lance Ulanoff

HAX and Other Such Tips For the C++ Literate

BY RICHARD HALE SHAW

When Jeff Duntemann and Keith Weiskamp founded *PC Techniques* in 1989, Duntemann coined the term *HAX* to describe the small yet knowledge-gap-filling articles they often published. Their new book, *PC Techniques C/C++ Power Tools: HAX, Techniques, and Hidden Knowledge*, is compendium of 140 previously published *HAX*—and a handful that have never appeared before.

Meticulously organized, each of the 22 chapters contains up to a dozen *HAX* on a given subject: identifying hardware, programming the keyboard, video programming, memory management, as well as DOS and Windows systems programming issues. Each of these *HAX* is a complete article that describes the problem and the solution in detail; it also includes a source code solution in C, C++, or assembly language.

While the source listings describe how to compile or assemble each module, the *HAX* fail to reference the issue of *PC Techniques* in which they originally appeared. And, although some batch files are provided, neither the book nor the included disk provide makefiles for building the programs. The programs almost exclusively support Borland's C++ and Turbo Assembler; some will port to other compilers with relative ease, while others will require considerable work.

The list of contributors will be familiar to readers of *PC Techniques*—Michael Abrash, Bruce Eckel, Jim Kyle, Tom Swan, and Kevin Weeks. While the book retains each author's voice, the editorial handiwork of Duntemann and Weiskamp lends it consistency. The result? An inspired, tightly focused work, rich with working solutions for PC applications and systems programmers.

If you find one programming problem that this book solves for you, the time you'll save will more than offset the cost.

For a more comprehensive study of C++, turn to Bruce Eckel's *C++ Inside & Out*. Eckel assumes that you know very little about C and guides you through the treacherous but rewarding landscape of object-oriented programming. It's written from the perspective that C++ was designed for small teams of developers writing large applications.

Based on the ANSI C and the ANSI C++ draft specification, the book begins with a brief introduction to the concepts of OOP and quickly plunges into the basic components of C/C++,

■ Another Way to Master OOP

With bookstore shelves practically bulging with C++ books, you'd think the last thing the world needs is another. But *Master C++: Let the PC Teach You Object-Oriented Programming*, by Rex Woollard, Robert Lafore, and Harry Henderson is different: It's a C++ tutorial, reference, and programming book, all rolled into one. And on top of that, it adds computer-based training software to let you learn C++ from your PC.

In some cases you can run the accompanying program and throw away the book.—*Richard Hale Shaw*

• *Master C++: Let the PC Teach You Object-Oriented Programming*, by Rex Woollard, Robert Lafore, and Harry Henderson, 1991, \$39.95. Waite Group Press, 800-368-9369. ISBN 1-878739-07-7.

Circle 515 on reader service card

such as language keywords and concepts. From the outset, Eckel introduces classes and gradually adds more and more language features.

Eckel is lively and clear, especially in his attention to detail. He concedes the dangers of too much type conversion, elaborates the pitfalls of dynamic memory allocation, and presents obscure language features.

The book reveals C++ internals that most books don't. The author patiently contrasts argument passing in C and C++, and outlines the pitfalls of overloading the C++ assignment operator. An entire chapter is devoted to C++ templates. Each chapter concludes with a makefile for building all of its examples. The book

embraces contemporary usages and conventions, and the examples were tested with both Borland and Microsoft C++. A source code disk is available separately.

The author achieves his purpose of elucidating a complex topic that's too often shrouded in obscure references and esoterica. In short, the author's concern for the reader's understanding is

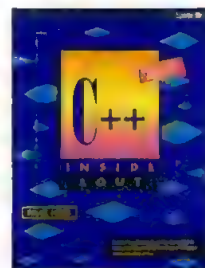
demonstrated in the book's organization, clarity, and meticulous explanations. If you can afford to buy only one C++ book this year, this is it. □

• *PC Techniques C/C++ Power Tools: HAX, Techniques, and Hidden Knowledge*, by Jeff Duntemann and Keith Weiskamp, \$39.95 (includes one 5.25-inch disk). Random House Electronic Publishing (formerly Bantam Books), 800-733-3000. ISBN: 0-553-37126-6.

Circle 512 on reader service card

• *C++ Inside & Out*, by Bruce Eckel, \$29.95. Osborne McGraw-Hill, 800-227-0900. ISBN: 0-07-881809-5.

Circle 513 on reader service card



Read Only Recommends

An exhaustive manual, covering just about everything any programmer should know. *Code Complete: A Practical Handbook of Software Construction*, by Steve McConnell, \$35. Microsoft Press, 800-227-4679.

Announcing special designed just for the

If you're one of the following people, your new 1994 DOS or Windows Quicken upgrade is now ready. Both new Quickens are so loaded with new time savings, new financial insight, and new power to organize — you'll think we redesigned it just for the unique way you personally use Quicken. For instance:

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You busy on-the-go types will love having Quicken organize your finances the way you organize all your other activities — with the new Quicken Financial Calendar.[™] It remembers whom you pay, how much, when, how often — and makes the register entries for you automatically.

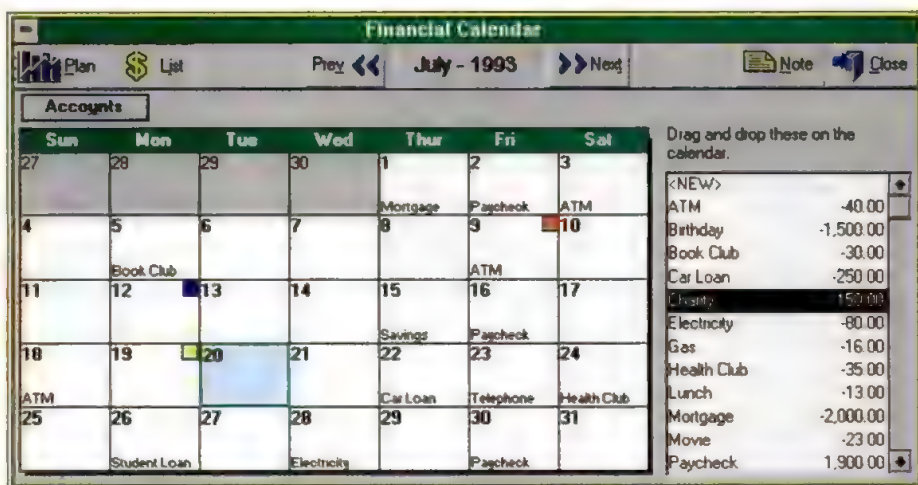
Whether the bill is a 36-payment car loan or a 360-payment mortgage, a twice-a-year property tax bill or your every-month phone bill — schedule it just once on the Financial Calendar, and you never have to enter it again. (You can confirm the amount each time if you wish.) And your regular deposits — weekly paychecks, monthly interest, whatever — are just as easy and convenient to handle automatically.

The Quicken Financial Calendar. It just may be the most radical planning-and-organizing tool since... well, the calendar.

B You just like knowing where your money goes

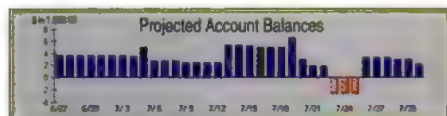
New QuickReports are just for you. Zoom out from any individual transaction in a register to see instantly when you last paid that bill or get a list of all transactions for that payee or category. It's like getting an instant "mini-report" any time you need it.

And for the first time ever, new Quicken 3 for Windows even forecasts your future. The new financial planning graph projects your account balances, cash flow and net worth for the next month — or up to the next



This could be the biggest breakthrough in Quicken ever! Just "drag and drop" transactions to the correct dates. Then let the new Quicken Financial Calendar make all your regular register entries for you automatically from now on. Or, you can put any transaction on "total automatic" and never look at it again — or you can be prompted each time to confirm (or change) the amount. You can also make one-time register entries with the Financial Calendar.

two years — based on the transactions you've scheduled onto the Financial Calendar.



Use this graph to play "What if..." and see the precise impact that decisions like saving more, vacationing sooner or even eating out less will have on your future account balances.

C You don't just organize — you analyze in detail.

You can compare this year's income and expenses with last year's, or analyze your cash flow with percentage breakdowns. The new comparison report shows any two periods side by side — sorted by account, category, payee or class. And it gives the variance in dollars, as a percentage, or both.

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Now you can see better than ever exactly how your retirement fund and investments are doing.

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And now it's much easier to enter new investment activity, too. Just fill out the new onscreen investment activity form. It prompts you for the specific information relevant to virtually any investment transaction.



Quicken upgrades following people:

You love Quicken's speed and ease

The new amount field calculator is radically different — and it's the most convenient onscreen calculator ever. Just type any equation (such as "2.75 + 4.95 x 1.08") directly into the Payment or Deposit column, and it enters the answer for you automatically.

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If you've been too busy to upgrade lately, you've been missing some very popular new features. Like QuickFill™.



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And learning new Quicken features is easier than ever, too — with new Qcards™ to guide you step by easy step.

You don't (and won't) do Windows.

New Quicken 7 for DOS has its own way of doing just about everything we've

mentioned for Windows, plus special features which DOS users in particular will appreciate. For starters, your graphs look better, work harder, and you can print them out, too.

New QuickZoom for graphs shows the "numbers behind the pictures." So you can press

"enter" on the graph of your May expenses,

for example, and zoom to a pie chart breakdown on them.

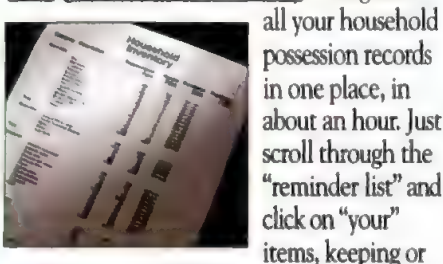
"Enter" again on any piece of that pie, and zoom to the trans-

actions behind it. Yet another "Quicken easy" way to answer your questions fast!

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DOS System Requirements: 100% IBM® compatible PC with 640 RAM, DOS 3.0 or higher, and a hard disk drive. Graphs require graphics card. Guaranteed to work with your printer or monitor, or your money back.

Windows System Requirements: 100% IBM® compatible PC, 286 or higher (386 recommended), Windows 3.1, 2MB RAM and 5MB free on your hard disk. **Quicken Companion** requires additional 2MB free on your hard disk. Works with any printer or monitor supported by Windows 3.1. Quicken 7 for DOS and Quicken 3 for Windows are file compatible.

Superior In E



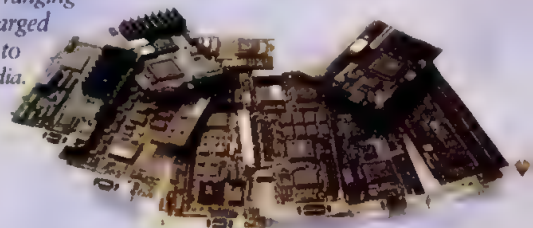
Every Nanao monitor undergoes intense scrutiny and testing to ensure maximum performance and product reliability. Our quality control processes and technical standards are among the most rigorous in the industry.

Our new line of Ecological Design™ Monitors incorporates advanced energy-saving features including PowerManager, which cuts power as much as 93% when the monitor is not in use. (After Dark screen saver software free with each monitor.)



Nanao was the first monitor company to join in partnership with the EPA Energy Star Program. Our commitment to bring technical innovation to today's environment ranges from eliminating CFCs in our manufacturing process to using recyclable packaging and paper products.

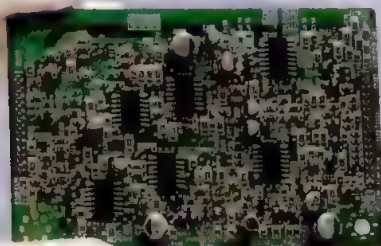
Nanao FLEXSCAN technology is compatible with all of today's popular graphics cards, offering a viewing environment ranging from enlarged graphics to multimedia.



Nanao's FLEXSCAN family of monitors meets safety specifications for radiation emissions established by the Swedish MPR-II guidelines as well as those of TCO, the Swedish Confederation of Professional Employees. Nanao was the first monitor manufacturer to achieve FCC Class B approval for our 80kHz frequency monitors.



High quality PCB boards are assembled, adjusted and inspected at Nanao's special chip-mounting factory. All PCB boards are built using sophisticated surface-mount technology.



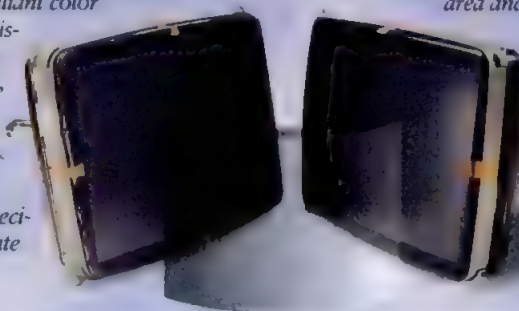
Model	Size	Dot Pitch	Scan Frequency	Recommended Resolution
T660r	21"	0.3mm	15.75kHz Vsync: 60Hz	1280x1024
T560r	17"	0.25mm	11.75kHz Vsync: 60Hz	1280x1024
F760r-W	21"	0.3mm	15.75kHz Vsync: 60Hz	1280x1024
F560r-W	17"	0.25mm	11.75kHz Vsync: 60Hz	1280x1024
F550r-W	17"	0.25mm	11.75kHz Vsync: 60Hz	1280x1024
F340r-W	15"	0.25mm	11.75kHz Vsync: 60Hz	1024x768

Nanao T-Series and F-Series monitors have captured every major award.



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Our high resolution CRTs deliver a complete range of color displays with photographic quality and brilliant color images to sophisticated applications like CAD, DTP and multimedia. TRINITRON[™] CRT models offer greater precision and intricate



detail, while Nanao's Invar Shadow Mask Flat Screen CRT models provide a wide display area and lower distortion image.

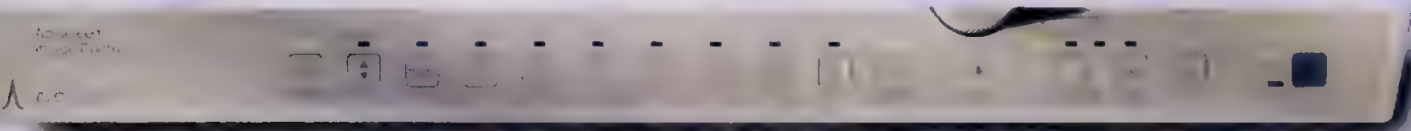
Both CRTs feature our unique built-in Dynamic Beam Spot Control System that ensures maximum brightness and sharp focus.



A heritage of precision craftsmanship and attention to detail has been designed into Nanao's family of display monitors.



To reduce glare, eliminate static electricity, and improve the focus level on the display area, Nanao has developed two anti-reflective innovations: ErgoCoat,[™] a protective coating for all F-series monitors, and ErgoPanel,[™] a sturdy panel that covers the surface of our T-series monitors.



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At Nanao, details make all the difference in creating our family of professional display monitors. From the product design and manufacturing that takes place in our factory to the end user's working environment, Nanao pays attention to every detail. In engineering. Assembly. Product testing. Quality control. Shipping. Customer support. From the very first days of the company, we set out to be an innovator in monitor technology. And, in a few short years, we have achieved that goal. Today, Nanao has the lowest repair rate in the monitor industry, the highest product reliability, and a fast-growing number of enthusiastic customers. So if you're looking for a superior monitor, start with the details. We do.



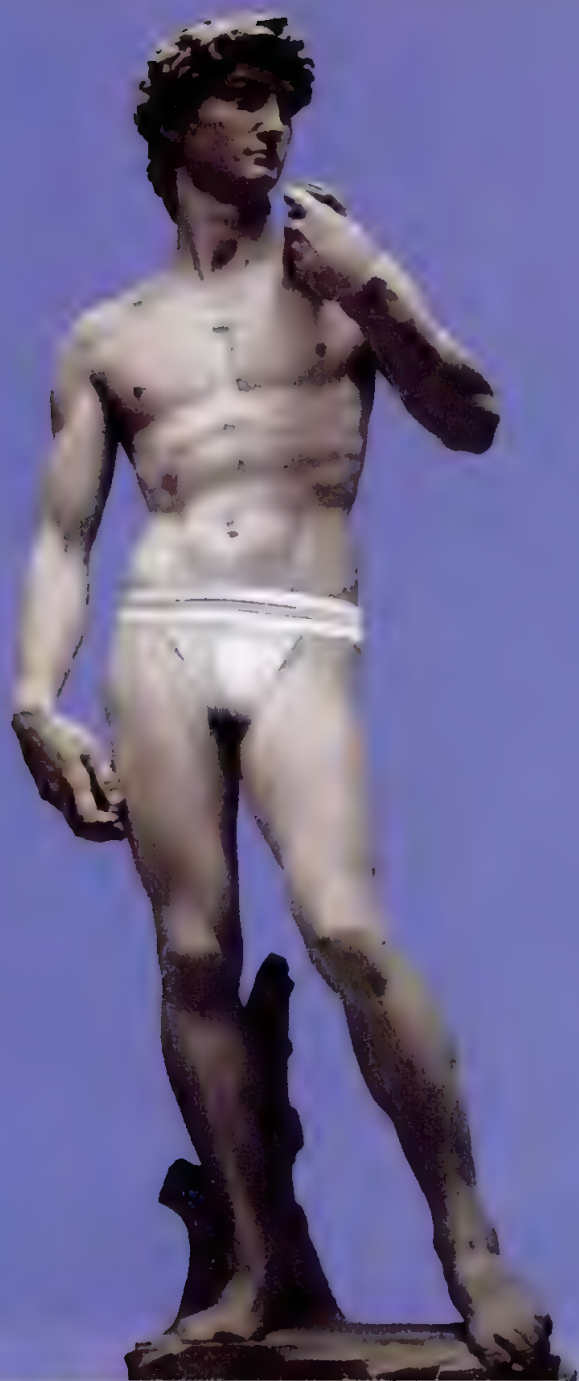
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Michael J. Miller

Objects in the Real World

Forget Windows NT, Workplace OS, and OS/2 2.1. The most important change in system software in 1993 is Object Linking and Embedding (OLE), Version 2.0. Why? Because it is likely to have the biggest impact on the way we work.

I've been using a variety of prerelease OLE 2.0-compliant applications lately, and it's completely altered the way I think about integrating applications.

Until now, Lotus SmartSuite has offered the best way of integrating software by having the most consistent user interface of any major family of software and, through what Lotus calls its Working Together Bonus Pack, a series of macros and icons designed to integrate Ami Pro and the rest of the Lotus applications family more effectively.

This is all well and good, and it's far better application integration than anything else that was available. But it's still a long way from letting you easily combine all the applications so that you can focus on your document and not on which applications to use.

THE RIGHT DIRECTION

With OLE 2.0, we're getting closer. Consider what I'm able to do using prerelease versions of Microsoft Word for Windows 6.0, Excel 5.0, and ShapeWare's Visio 2.0.

I usually start with a Microsoft Word document. If I want to get a fancy text effect, I choose the Insert Object command, pick WordArt 2.0, and select from a variety of text curves, shadows, fonts, colors, and shading. Now, while all of this was possible using the previous version of Word, this time there's a big difference: Instead of moving into an obviously separate application, all I have to change is my menus and my toolbar. I still see the rest of my document. OLE 2.0's menu- and toolbar-negotiation features make this possible. If, at a later time, I want to edit the WordArt object, I just double-click on it, and again the toolbar and menus change, yet I still see the whole document. This is real *in-place editing*.

As a result, the text and inserted art object feel

much more like elements of one document than like two documents that happen to be connected.

Of course, I do all this with a mini-application that ships with Word. But what if I want to copy a chart from an Excel spreadsheet into my document?

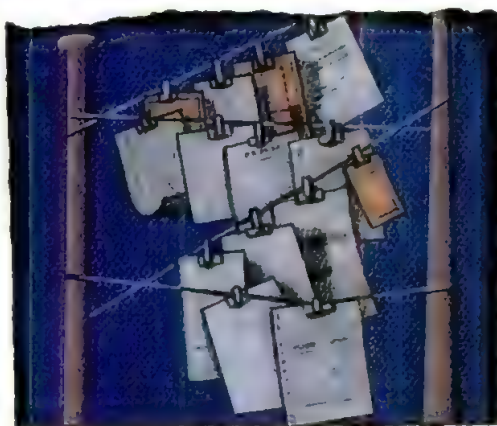
With OLE 2.0, the easiest thing to do is to bring up Excel, tile the windows so that I can see both Excel and Word, and then simply select the chart, drag it into the Word document, and drop it. This drag-and-drop feature is a really simple way to move information between two documents or applications. You don't have to think about keyboard commands, toolbar icons, or the Windows Clipboard.

WE'RE ALL CONNECTED

Word and Excel have other connections as well. Previous versions of Word featured a tool for inserting a table into your document. That table toolbar icon is still there, but next to it is a new icon that lets you insert an Excel spreadsheet of whatever size directly into the document. Again, you see your full word processing document, and you still have Word's File and Window menus. But Excel's toolbar, and its Edit, View, and other pull-down menus, have temporarily replaced Word's own. Again, this is just editing in place.

When I do this, am I in Word? Am I in Excel? The answer is both, and neither. I'm in my *document*.

Okay, so Microsoft got Word and Excel to work better together. What about third-party applications? I've never been a big fan of the drawing tools that come with Microsoft Word, in part because I'm not an artist. But I'm pretty good at dragging and dropping, and that's where Visio comes in. Visio is a drawing tool that features a library of highly customizable objects and



OLE 2.0 could make documents the center of your world.



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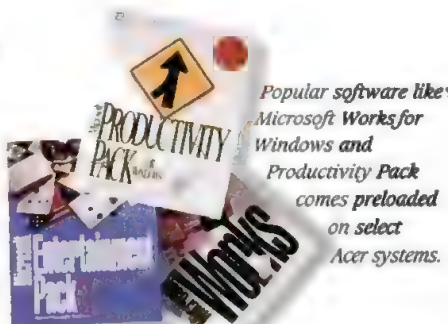


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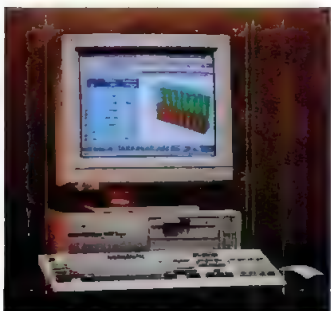
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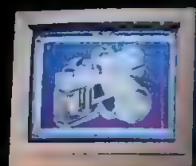
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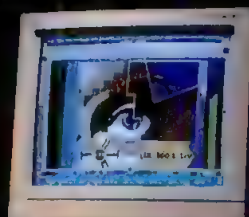
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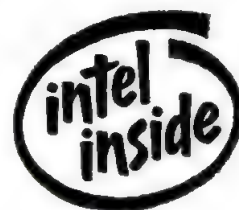
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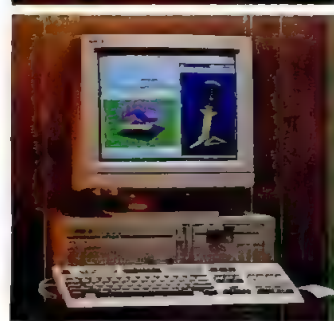
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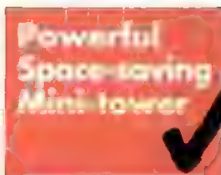


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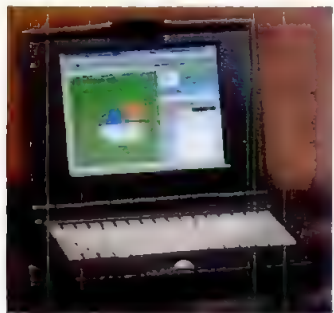


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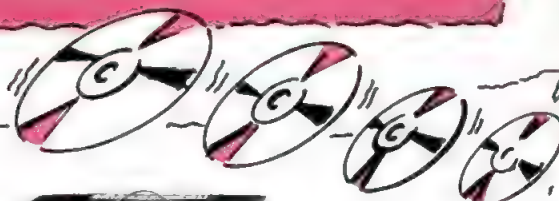
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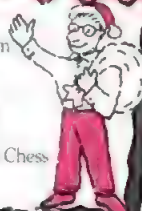
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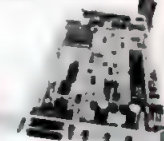


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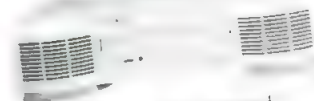
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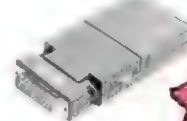


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Bill Machrone

The Convergence Scam

The eighties are back with a vengeance. The arbs and investment bankers are back from their banishment, gleeful over the billions of dollars flowing around studio deals and home shopping channels. Wall Street is utterly intoxicated by the heady

mix of media, stars, satellites, cables, and networks.

All of these activities hinge on a single buzzword: convergence. The theory behind convergence is that all media are going digital and that televisions are essentially becoming computers, either directly or by virtue of the set-top box. Convergence posits a future of 500 cable channels, high-speed digital links into our homes, and a new generation of sofa spuds staring fixedly into the screen, occasionally thumbing the "Buy It!" button on their remotes. It also assumes that various forms of interactive entertainment will become the norm. It posits stories with alternate endings and the ability to make the characters interact in viewer-directed ways. Personally, I don't think this concept will ever fly. It's just too expensive to produce decent-quality video or film that may never be watched. It's conceivable that we will someday have digitized actors and actresses who will be convincing enough, but I think it's akin to searching Bugs Bunny's face for emotional nuances.

The original promoters of television couldn't envision the form it would take in the marketplace. They thought it would be a conduit for locally produced music and theater into the home, something that hasn't been realized 40 years later, even with cable and local access laws. In the same way, we can't envision the changes that interactivity will bring. Rather than interactive dramas and sitcoms, it's more likely that you'll choose your own camera angles and replays of sporting events. The fight for the remote control, however, might make a border skirmish in one of those sweaty equatorial countries look tame by comparison. One thing is certain: wideband, multichannel television is a new medium, which will require new content. The

medium may still be the message, but only if the content is appropriate.

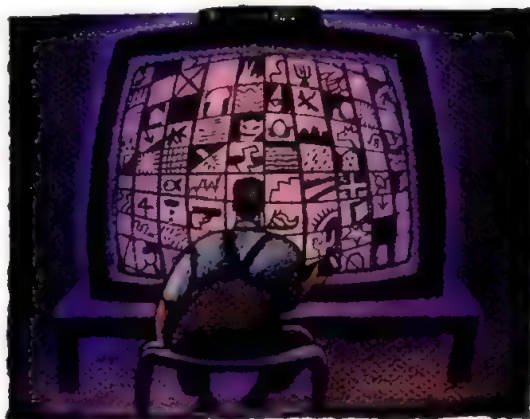
OLD WINE, NEW BOTTLES

All of which makes me wonder why Paramount's (or Columbia's, or MGM's) trove of films is so valuable to the cable industry. It's reminiscent of real estate deals, waiting for the price to go up. "Buy land," said homespun philosopher Will Rogers. "They ain't makin' any more of it." They are, however, making many more films. Yes, there's a business in remarketing old films in new formats and yes, a legion of insomniacs and timeshifters await their transmission into our homes, but they don't require new technology, greater bandwidth, or more channels. The growing consumer electronics phenomenon of home theater, with larger screens and surround sound, may presage either massive video libraries at home or on-line access to centralized libraries, but nostalgia only goes so far. Newer films, recorded in full surround sound, are far more enjoyable, all other things being equal.

Convergence has also slowed the adoption of HDTV. Japan has had high-definition television for several years, but its system is analog, and the pixels are not

square, which makes them less suitable for computer manipulation. The United States' system will be digital and will be better for it, but making it compatible with computer systems is not worth the delay. Our existing desktop Super VGA systems already rival HDTV: you'd give your eyeteeth for a television image with 1,024-by-768 resolution and a 72-Hz refresh rate. Convergence says that the two must interoperate; common sense says they never will.

I've said in the past that the television is a far more passive medium than the



*Convergence posits a new generation
of cocooning, telecommuting
sofa spuds fighting for the remote.*

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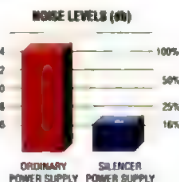


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Bill Machrone

computer, and it's supposed to be. The queries to interactive databases aren't going to be handled from your television, but from your computer. There's too much competition for the TV already. You simply are not going to give up Monday Night Football gracefully so the kids can use the TV to query some on-line encyclopedia for their homework.

Likewise the always promised, never delivered picture phone. Nobody wants an expensive, dedicated device with limited resolution and certain, speedy obsolescence. Ditto the touch-screen phone, where we do our banking and shopping from handy video menus. The PC is a far more practical platform for desktop-to-desktop video because it can adapt itself to a wide range of existing and emerging technologies.

TAKE BACK THE NIGHT

Let's also dismiss the notion that we're becoming a nation of cocooners, talking to one another through electronic media from behind barred and bolted doors because we're too scared to go outside. Granted, streets are not as safe as they once were, but it's up to us as a society to decide what we want to do about that. It may have to get worse before it gets better, but the pendulum will inevitably swing. Researchers have inferred far too much from the amount of time the TV is on in the average American household. We take their pronouncements seriously, yet would laugh in their faces if they tried to infer anything about our office activities from the amount of time our PCs are on at work. Seven hours of TV time per day per household is not interaction. It's not even watching. It's a talking lamp.

Cocooning and telecommuting are real phenomena, but they're an escape from the wasted time and energy of commuting and refuge from crowded venues and sticky, popcorn-coated floors. The amount of time spent in leisure activities outside the home is going up, not down.

As Katherine Ann Porter wrote, "Everything that rises must converge." The growing similarity between televisions and computers is nothing more than finishing school for the TV, a graduate course in the competent handling of content. Without content, convergence is bereft of meaning, and content depends heavily on the medium. Content is king, and the personal computer is its foot soldier. □

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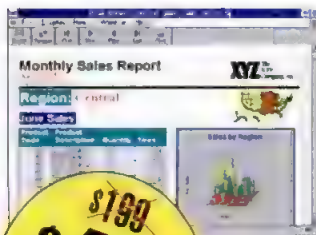
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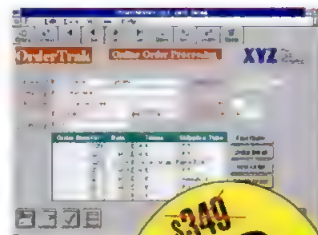
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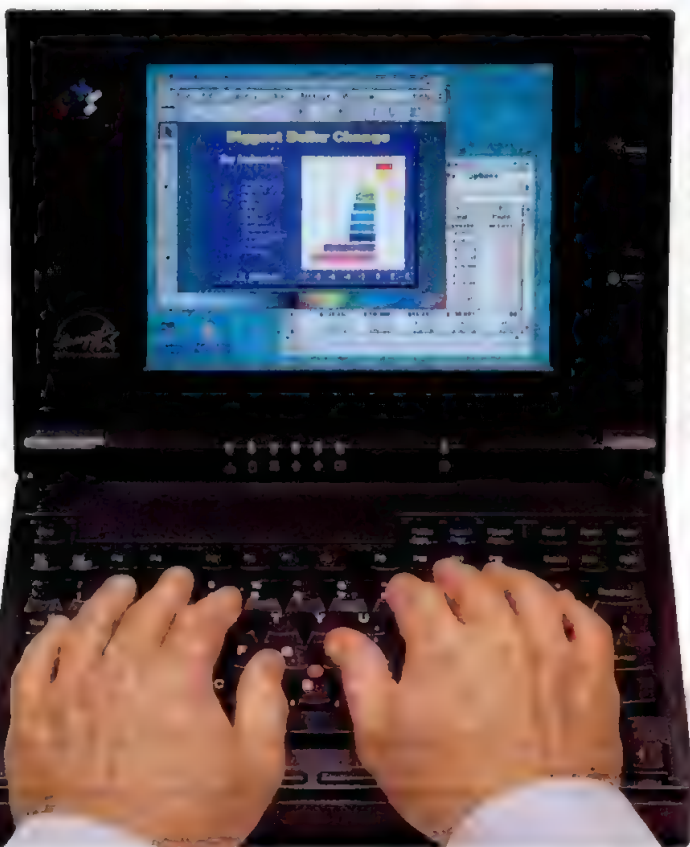
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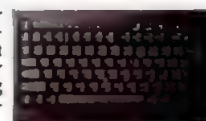
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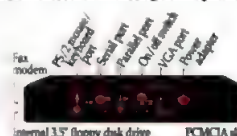
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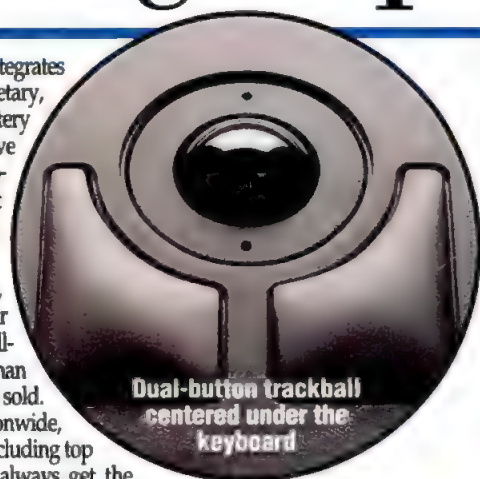
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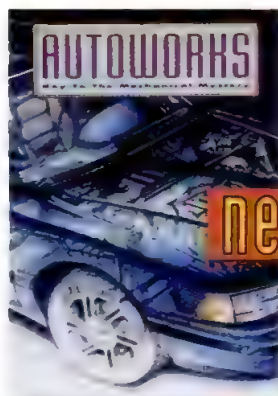
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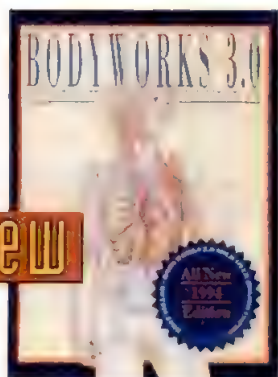
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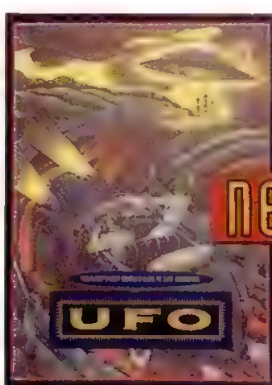
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The Research Is Dead Wrong

Dataquest has announced the results of a survey in which 64 percent of all respondents indicated a low demand for the addition of desktop videoconferencing equipment in the next year. Low demand for additional equipment over the next year was also indi-

cated by 54 percent of the respondents who currently use videoconferencing technology. There is great hope among many technology companies that videoconferencing will be the 'killer application' that will accelerate the trend toward multimedia, said Bruce Ryon, principal analyst in charge of Dataquest's Multimedia service. The results of our survey certainly don't support these hopes." *As reported in ZiffNet's Newsbytes and elsewhere.*

So there I am in a session at Compaq's Innovate '93 with a group of industry pundits, and I make the claim that desktop-video teleconferencing will become the killer app of the 1990s. Then former PC Mag publisher/editor Bill Machrone chimes in. "I've been doing a little survey over the past year: When I talk to people over the phone, I ask them if they would prefer the conversation to be a video telephone call, and they all say 'no'." He went on to suggest that many wouldn't mind if they could see you but you couldn't see them.

Well, the Dataquest survey is a bit off in its conclusions, just as Bill is off in his. Both are based on the wrong premise. For years I've pooh-poohed the idea of a head-shot-oriented video phone except as a gimmick. It's not face-to-face picture-phone chitchats that make this an important technology. In fact, it's not teleconferencing at all!

MEDIUMS AND MESSAGES

The potential of TV joined to the computer lies in the McLuhanesque extension of the individual. I advise you to reread *Understanding Media* by Marshall McLuhan. This notion was brought to my attention when I was at IBM's research facility in Hursley, England, where I saw a product called Person-to-Person being demonstrated. Person-to-Person networks personal video cameras within the com-

pany in all sorts of innovative and useful ways.

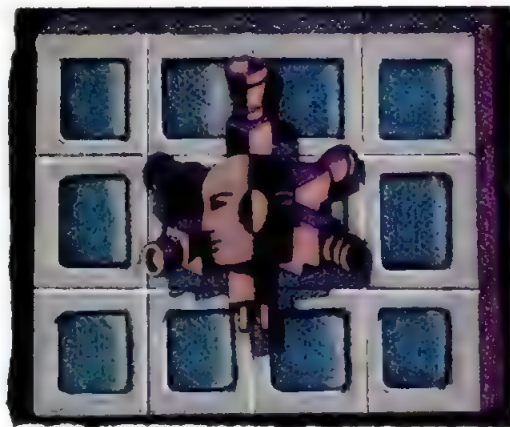
Here's a scenario, and you tell me that you wouldn't want this on your desktop:

Let's say we have a network of people running Person-to-Person over ISDN, high-speed modems, in-house networks—whatever can be interfaced. I boot Person-to-Person, call Ken across town, link into his computer, and access his Person-to-Person module. From there, I toggle to one of his six computer-linked cameras to check traffic conditions outside his home to decide if I want to take that route to get to the office. Meanwhile, I get a message over the line that there's an intruder in my cabin outside Casper, Wyoming. I call my Person-to-Person module in Wyoming and look through the house, going from camera to camera, room to room. I see some idiot roaming around my house. First, I capture him on video, and then I send my voice over the system and tell him to get out of my house and lock the door! Stunned by this, he quickly leaves.

I also imagine using these remote cameras to look at the checkout lines at Safeway to see when's a good time to shop, and for watching fireworks in Paris. Some of these video services will become the next-generation

equivalent of a computerized bulletin-board system. The possibilities are endless, and this is the way desktop-video "teleconferencing" is going to evolve. It's not like 500 channels of cable programming, either. It's thousands and thousands of video feeds from every imaginable corner of the country.

Ask one of your computer-using friends if he or she would be interested in something like this in a small window in the corner of the PC screen. I'd advise Dataquest to try its research again, this time using my description as the premise.



Videoconferencing's potential may be lost on some, but Marshall McLuhan knew what he was talking about.

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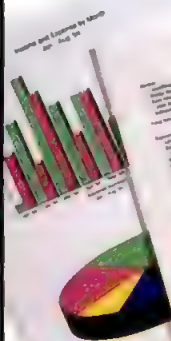
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- And much more



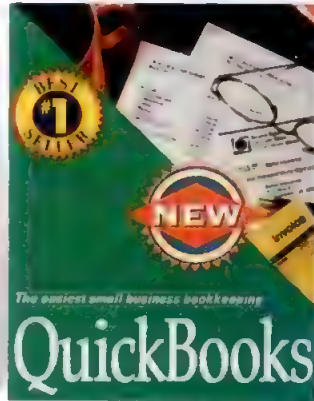
Comparative Profit and Loss
1994 vs. 1993

	1994	1993
Sales	1,200,000	1,100,000
Cost of Goods Sold	(600,000)	(550,000)
Gross Profit	600,000	550,000
Operating Expenses	(300,000)	(280,000)
Operating Profit	300,000	270,000

AP Aging Summary
As of March 31, 1994

Group	1-30	31-60	61-90	91-120	121-180	181-360	Total
Accounts Payable	1,200	800	500	300	200	100	3,000
Accounts Receivable	500	400	300	200	100	50	1,500
Inventory	100	100	100	100	100	100	600
Fixed Assets	0	0	0	0	0	0	0
Liabilities	0	0	0	0	0	0	0
Equity	0	0	0	0	0	0	0

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Inside Track

T

here's a lot of talk in the industry about IBM's new "clean room" project to create its own version of the 486 microcode. The **purported goal** is to add silicon to the PowerPC 601 chip to allow IBM's next-generation PC the ability to run both native x86 apps and PowerPC apps.

I've always found this project a **bit peculiar**, since the 601 is supposed to be the **perfect chip** for emulation, and you'd think that would be a cheaper way to go. Well, some people now believe that IBM is fashioning a **big misinformation campaign**—that the company is indeed reverse-engineering the 486, but that this project has nothing to do with the PowerPC. Instead, IBM intends to **clone the 486** and the Pentium as well so it can produce and sell chips against Intel (and AMD, and Cyrix, and TI). This is where the money is.

Currently, IBM has a license to make Intel chips but is restricted from selling them, except for use in its own systems or on IBM motherboards. It can't sell **raw chips** under the license. While IBM has suddenly become a leader in motherboard manufacturing with a line of motherboards containing IBM's 486, it wants to sell bulk processors—especially the clock-tripled chips that Intel seems reluctant to produce. Some observers watching the current aggressiveness of IBM are calling it the "wounded bear syndrome." That is, IBM sees everyone as the **enemy** and intends to be in all markets.

Meanwhile, Intel is still **struggling** internally with the Pentium. The company needs to get the Pentium into the market, but it's essentially losing **money** on each chip it makes. Intel's not making as **much money** as it would make if the time and resources were instead spent on 486 production. The word in the valley is that the company loses seven 486s when it makes one Pentium. This is a function of yield and die-size. Since the 486DX2/66 sells for about \$400 and the Pentium sells for about \$950, you can see why certain Intel managers—whose compensations are adjusted as profits go up and down—are **squawking**.

Dvorak's Quick Analysis: In fact, Intel is doing the right thing by **forcing the Pentium** out of the door. Intel is a technology leader, and its leadership is paramount to continued success. It has to push the newest stuff at the expense of a **cash cow**. No bull!

Trends You Can Count On: As you know, I've been following the upcoming bloodbath in hi-res monitors. Every monitor company is jockeying for the

Intel is doing the right thing by forcing the Pentium out the door. Intel is a technology leader, and its leadership is paramount to continued success. It has to push the newest stuff at the expense of a cash cow.

dominant slot by offering new features. Just as multisync, multi-scan monitors dominated the late 1980s, look for something called **Continuous Scan** to dominate the rest of this decade. Sony will probably be first with one as it tries to wrestle the number-one spot away from NEC, which has been coasting with its FG series for a couple of years.

Internet Humor Dept.: Anyone with an Internet connection knows it's good for three things: (1) cheap e-mail, (2) rapid propagation of bogus rumors, (3) nerdy urban folklore (a.k.a. jokes and humorous observations passed from person to person). Here's the latest story passed around the net:

True story, happened yesterday.

Paul Mockapetrus was at Bellcore watching a demonstration of Tennenhouse's Vu-net connected to a Sunshine switch and the Aurora network. The Vu-net physical hardware is roughly three large PC boards sitting on a table with wires hanging all over the place. The Sunshine switch was sitting next to it, with even more wires hanging out.

Paul M (standing over Vu-net and peering at it): "Sure doesn't look like an information superhighway to me."

Bruce Davie: "Do you want me to paint a yellow stripe down the middle?"

I guess you had to be there.

The MCI Mail Test Dept.: Although customer service **denied** that MCI has a 14.4-kilobit-per-second link, the company's been testing it for a few months. Set your modem to 38,400 bits per second and call the old MCI 2,400-bps modem line at 800-456-6245 and **bingo! You're connected** at V.32bis (14.4 kilobits per second) and V.42bis. Great speed for those Zmodem downloads. I suppose MCI isn't talking about it since it seems to run only about 20 percent faster than the 9,600-bps link. If you're **into speed**, then also check CompuServe for the new 14.4-Kbps phone numbers. Gee, just in time for V.FAST.

Genuinely Interesting Gizmo Dept.: It's called the **MotorMouse**, a switchable two- or three-button mouse in the shape of a Lamborghini or Corvette. You push down on the hood to get the button action. The mouse comes in red, white, and yellow. The **red Corvette** looks great! List price is \$65.99, but there's an introductory offer at \$59.95. This is a **perfect gift** for the person who has everything. The company can be reached by calling 604-681-6062, or writing MotorMouse at 126 Garden Ave., North Vancouver, BC V7P 3H2 or P.O. Box 9754, 3873 Airport Way, Bellingham, WA 98227-9754.□



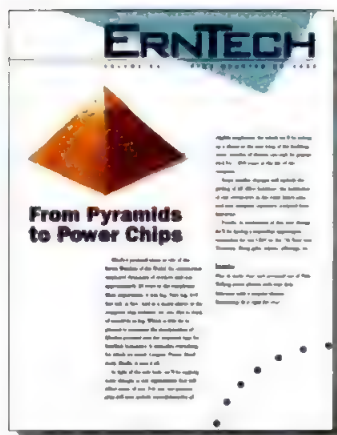
20 years.

100,000 men.

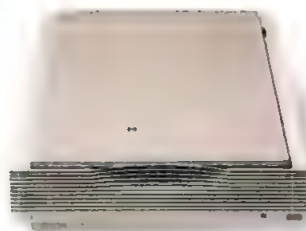
752 casualties.

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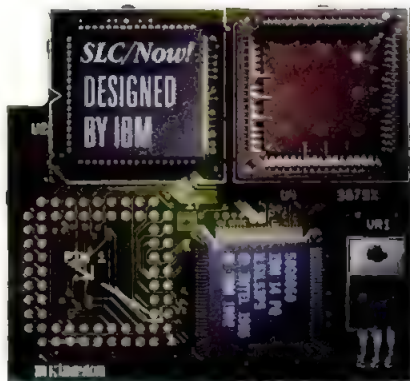
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Recount:	5:44 Min.	1:51 Min.	1:54 Min.	
Retail Price:		\$215	\$1,545	
SLC/Now!	PS/2 Model 50	With SLC/Now! 50	PS/2 Model 90-0H9	SLC/Now!
Landmark Speed 2.0:	13 MHz	114 MHz	84 MHz	IBM PS/2 Models 50, 50Z and 60
Recount:	3:34 Min.	:29 Sec.	:38 Sec.	
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Landmark Speed 2.0:	39 MHz	84 MHz	84 MHz	IBM PS/2 Models 70 and 80, Compaq Deskpro Models 386/16, 386/20, 386/20e, 386/25, 386/25e, 386/33
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CIRCLE 106 ON READER SERVICE CARD



Jim Seymour

No Mo' Modes

A year and a half ago I was in Redmond, Washington, at Microsoft, talking with a friend who was involved in development work on OLE, Version 2.0. The long-awaited successor to Object Linking and Embedding, Version 1.0—a fairly dim-

witted pseudoreplacement for Dynamic Data Exchange (itself no prize)—was nearly ready, he said, and would soon be passed along to applications developers inside and outside Microsoft.

"It's great," my friend said, "but I think it's going to be a year before you see it show up even in *our* applications, maybe 18 months before anybody else is using it. Because this stuff is *harrrrrd*."

He missed on the timing, as developers always do: It's taken 18 months for the first applications using OLE 2.0 to appear, and we're just starting to see the first OLE 2.0-aware apps from other vendors. But he didn't miss at all on his main point. This stuff really is hard; that is, it's hard to implement but not to understand or benefit from.

Microsoft hasn't helped make OLE 2.0 easier to implement. So far, the so-called OLE 2.0 spec has been less a specification than a moving target. And this has infuriated applications developers who've been forced to zig and zag in the wake of Microsoft's constant changes.

Elsewhere in this issue, editor-in-chief Michael Miller describes some of what goes on behind closed doors in OLE 2.0, and tells one of the things he likes best: that its drag-and-drop features are so easy to understand, use, and teach to others.

Agreed, Michael: Drag-and-drop finally reaches center stage in OLE 2.0 and becomes a way of working, as opposed to a way of *trying* to work. When we see Cairo/Windows 4.0 next year, with rich drag-and-drop in the operating system as well, we'll really be sitting pretty.

But as good as real drag-and-drop is, it isn't my favorite part of OLE 2.0. I think the really powerful and important part of OLE 2.0 is *editing in place*. This is, to borrow a golden oldie,

"how computers are supposed to work."

And it's the biggest step yet on that most important road of all in producing better, smarter software: ending the curse of modes.

BACK AND FORTH...AND BACK

If you get down to the nub of what's wrong with applications software, it comes to this: We have to work with these programs, not with our *work*. That's because we have to think about how to do something, and then shift gears to select and use the right tools.

Want to write a letter? Okay, you need to know that you'll need a word processor (read *word-mode program*). Go to work. Now, want to put a graph in that letter? Fine. Load your spreadsheet or graphics package (read *graphing-mode program*), build the graph, then paste it into the letter. Write some more (back to the word-mode program). Realize you need to change something in the graph? Fine. Switch back to your spreadsheet or graphics package (back to the graphing-mode program).

That need to jump between computer programs—as opposed to jumping between your ideas—is in my mind the stupidest thing about computers. (I concede that it's been worse: Early word processors were insanely modal, requiring us to enter text in one mode and then switch to a second mode to edit the same text.)

The advent of Windows and OLE 1.0 made things a little easier. Once a graph was placed in the letter, we could double-click on it, and Windows would switch to the graphing program. When we were through changing the graph, we could go back to our word processor to finish the letter, with the dynamic link between the source graph and the one in the letter nicely updated.



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Jim Seymour

But that wasn't much of an improvement. We still had to wait while the computer switched programs, repainted the screen, and presented us with a verywell, modal view of our work.

OLE 2.0 changes the rules. Now, when you click on the graph, all that happens is that the menu bar across the top of your screen changes, displaying the commands for the program used to create the graph. You immediately have available all the tools needed to change the graph. When you're finished, a quick click in the text of the letter takes you back to the word processor's menu bar.

In other words, you edit either the text or the graph in place, without jumping out of your document to the graphing program to edit a primary representation of the graph, then returning to a secondary representation of it in the letter.

The transaction involves an OLE server ("object") and an OLE client ("container"). When we have enough new Windows apps that fully support OLE 2.0, a given document might be an OLE client to several apps functioning as OLE servers. All the messy stuff happens behind the scenes; you can focus on your work, not on the mechanics or on the denominations and sects of the PC software world.

This kind of editing in place still isn't perfect. But it's much better than we've ever had before, and it sparkles with the promise of worlds to come. We're not yet fully out of the modal trap, but we're near enough that we can finally see beyond it, in succeeding generations of OLE (and possibly other similar architectures), to truly modeless operation.

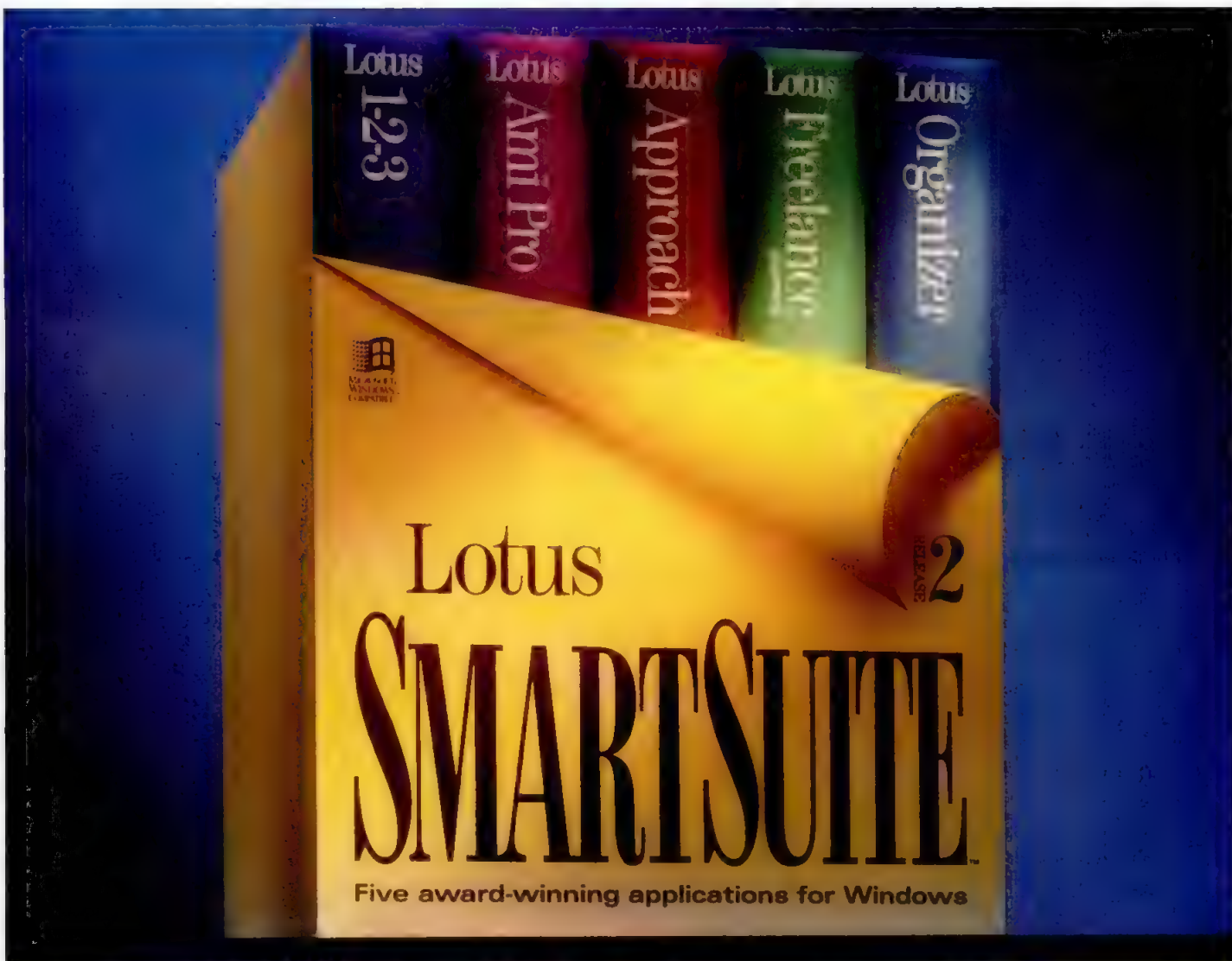
All this is fairly self-evident to anyone who's played with beta versions of Word for Windows 6.0 and Excel 5.0, the two primary OLE 2.0-aware apps now becoming available in release versions.

But I'm surprised at how few of the industry's gurus and seers—all fans of OLE 2.0—have seen beyond the simple pleasures of using drag-and-drop and editing in place to the far-reaching effects of OLE 2.0.

After screaming about the evils of mode-based software for decades, we can now step along a nearly modeless path to a completely mode-free future. OLE 2.0 is a big, big win for both software developers and PC users. I'd go so far as to say that it's the most important development in PC software of 1993. □

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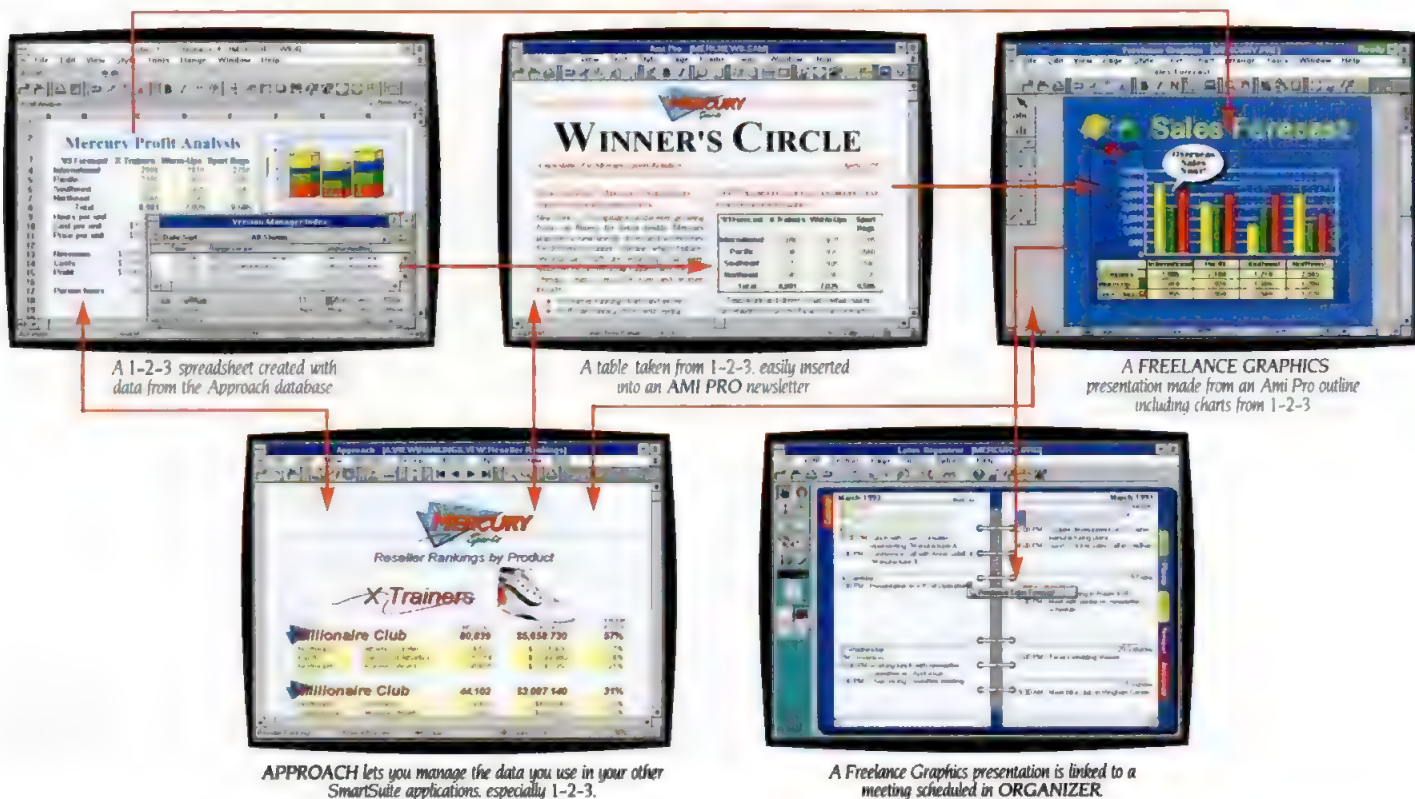
The five applications in SmartSuite also set new standards for integration.

(Our leading competitor boasts that its spreadsheet word processor and presentation software will have some consistency too... when the new releases are ready.)

Lotus also leads the way for sharing information across applica-

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With a single mouse click you can easily edit 1-2-3 charts from within Freelance Graphics. You can seamlessly perform a mailmerge in Ami Pro with data from Approach.



First, to make it all easier and reduce training costs, they offer consistent appearance and behavior between applications. For example, SmartSuite applications share common menus, Live Status Bars and SmartIcons.* In fact, 1-2-3, Ami Pro and Freelance Graphics share 26 common SmartIcons.

tions and using functions from one application while working in another. This goes beyond basic OLE and DDE through a feature called



The Application Manager displays all five application icons, just point and click on an icon in the Application Manager to launch or switch into a new application.

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Bill Howard

Building My Next Dream Machine

What do I want in my next PC?: Speed? Reliability? Low price? When it comes to the next computer I buy, I believe the decision hinges on something more mundane: features. And I don't mean the major features, such as the number of slots or the

hard-disk capacity. Rather, I mean the design touches that show an understanding of how real people use personal computers.

So here's a highly personal checklist of what I'd look for in my next desktop PC:

I'd order the system with the most versatile of cases. I'd start with the 16-inch-tall mini-tower. Everything else is too much or too little. My system would have two (actually three) accessible 5.25-inch drive bays, one for the obligatory CD-ROM drive, the second for a dual-media 3.5-inch and 5.25-inch floppy disk drive. The 5.25-inch floppy has no future, but for 50 bucks extra, I can read and write old floppy disks. Compaq goofed big time when it didn't allow for even a single 5.25-inch bay on the first release of the home-oriented Presario.

COOL, QUIET POWER

Power-supply fan noise bothers me only slightly. Even so, I know I'd want a two-speed thermostatically controlled fan or else one of those whisper-quiet power supplies from PC Power & Cooling. Today's computer components use less power, so I no longer have the need for a 200-watt power supply on a desktop system.

I want the power switch on the front (not on the side). There should be a switched AC outlet on the back that automatically powers up the monitor.

On the back of the system unit, I'd want PS/2-style connectors for the keyboard and mouse, not an AT-style keyboard connector, and not a serial mouse connector. The I/O ports should be labeled (not blank), using words such as *parallel* or *keyboard* (not icons), and they should be marked with high-contrast labels (not beige-on-beige moldings). The cables and the system case should be

secured with thumbscrews (no screwdriver required).

I want a CD-ROM drive (triple- or double-speed) and a 16-bit sound board (with DSP and sound wavetables rather than synthesized sounds). And I want the vendor to preinstall them.

The debate over SCSI versus IDE technology for drives leaves me unmoved. IDE is cheap and it works, so I'd probably choose that for my 500MB hard disk. For the CD-ROM drive, I'd take SCSI, but not the proprietary near-SCSI you find on some sound board/CD-ROM combos.

GREEN AND COMFORTABLE

I'd get a low-power (Energy Star Computers) PC, not just for the lower electric bills but for the reduced thermal gain and for the confidence factor that allows you to leave the PC on but sleeping during off-hours, exactly as my TV is powered up but sleeping right now. Then I can use the PC as a 24-hour fax and answering machine.

This PC should come with remote diagnostics, so if it doesn't work right, a technician can dial up the PC and see if there's an easy fix.

And if there's one place I'd spend a bit extra, it would be on a 17-inch monitor.

There's more. We're on the verge of half a dozen significant advances in the next 12 months. The features to watch for: clock-tripled PCs (486DX3/100 CPUs); shipping-in-quantity—and, soon after, more affordable—Pentiums; and plug-and-play add-in cards that resolve conflicts without requiring you to play UN peace-keeper. But these won't happen in one fell swoop, so I wouldn't say, "If I just wait two more months, I'll get a radically better PC." I know I'll just put these features on my PC wish list for the end of 1994. □



*Sure, my next PC will be fast,
but the little touches
are even more important.*

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Slimline S425SX

- 486SX, 25 MHz
- Upgradeable to Pentium technology
- 4MB RAM, max: 36MB
- 128KB processor cache
- 3.5" 1.44MB diskette drive
- 170MB (17ms) hard disk
- 3 storage bays
- 3 16-bit ISA slots (2 VESA on local bus)
- Windows accelerator w/ 1MB video memory
- 14" SVGA LR color monitor
- Slimline casing (3 x 3)
- MS-DOS® 6.0, Windows™ 3.1, mouse

\$1,339



Slimline S450DX

- 486DX2, 50 MHz
- Upgradeable to Pentium technology
- 4MB RAM, max: 36MB
- 128KB processor cache
- 3.5" 1.44MB diskette drive
- 240MB (15ms) hard disk
- 3 16-bit ISA slots (2 VESA on local bus)
- 3 storage bays
- Windows accelerator with 1MB video memory
- 14" SVGA LR color monitor
- Slimline casing (3 x 3)
- MS-DOS 6.0, Windows 3.1, mouse

\$1,815



Desktop D466E/VL

- 486DX2, 66 MHz
- Upgradeable to true 64-bit Pentium technology
- 8MB RAM, max: 64MB
- 256KB processor cache
- 3.5" 1.44MB diskette drive
- 440MB (12ms) hard disk
- 8 32-bit EISA slots (2 VESA on local bus)
- 6 storage bays
- 53 video accelerator with 1MB DRAM
- 15" Flat Square LR color monitor, NI
- Desktop casing (8 x 6; convertible to minitower)
- MS-DOS 6.0, Windows 3.1, mouse

\$2,959



Minitower T466DX

- 486DX2, 66 MHz
- Upgradeable to Pentium technology
- 8MB RAM, max: 64MB
- 256KB processor cache
- 3.5" 1.44MB diskette drive
- 340MB (12ms) hard disk
- Onboard SCSI
- 8 16-bit ISA slots (2 VESA on local bus)
- 6 storage bays
- Windows accelerator with 1MB video memory
- CD-ROM drive
- 14" SVGA LR color monitor
- Network-ready (Ethernet 10BaseT)
- Minitower casing (8 x 6)
- MS-DOS 6.0, Windows 3.1, mouse

\$2,694



Pentium DP60E/VL

- Intel Pentium processor, 60 MHz
- 64-bit processor complex
- 8MB RAM, max: 64MB
- 256KB processor cache
- 3.5" 1.44MB diskette drive
- 540MB SCSI hard disk
- Onboard dual-channel Fast SCSI-2
- 8 32-bit EISA slots (2 VESA on local bus)
- 6 storage bays
- ATI® Ultra Pro™ Mach 32, 2MB VRAM
- 14" SVGA LR color monitor
- Desktop casing (8 x 6; convertible to minitower)
- 200-watt autoswitching power supply
- MS-DOS 6.0, Windows 3.1, mouse

\$3,999



Notebook NC425SL

- 486SX, 25 MHz, SL-Enhanced
- Dual-scan STN color screen
- Integrated fax/modem
- 4MB RAM
- 120MB hard disk
- Integrated trackball
- MS-DOS, Windows, MS-Works™

\$2,449



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The 486 BUYERS' GUIDE

With so many choices confronting the computer buyer, confusion and frustration are the result.

PC Magazine cuts through the marketing hype to evaluate 89 lines of PCs.

by Jim Seymour

We know it's a jungle out there. The variety of good PCs available from reliable vendors is unprecedented, and far from making it easier to buy the right PC, the multitude of good choices just makes it harder.

Recent improvements in the quality, performance, and compatibility of such key components as ROM, BIOSes, video cards, and motherboards, actually make it easier than ever to get a *good* PC. Quality and performance standards are higher, and the variety of included features has never been richer. But, at the same time, it's undeniably more difficult than ever to wade through the ocean of hype to buy the right computer for your purposes. The irony is that it is now the best of times and the worst of times to buy a PC.

Our answer is The 486 Buyers' Guide—a one-stop shopping guide that surveys mainstream desktop computing and assists you in navigating the maze of vendors, product lines, configurations, options, and prices. We began by asking PC makers to send us two or more representative machines from each line they make

and sell. The only other requirements were that the units be currently shipping and meet these minimum specs: 486 processor, 16MB of RAM, 300MB hard disk, 14-inch monitor, DOS, Windows, and a mouse. In the coming pages we evaluate 191 PCs divided into 89 lines. Since our deadline, IBM revamped its PS/1 and PS/2 lines, CompuAdd brought out nearly 50 new PCs, and Everex released its Hercules line.

BY THE LINES

The parallel lines offered by most PC vendors can confuse and frustrate even the most experienced PC buyers. At first, vendors divided their lines into desktop PCs and network servers. Compaq's Deskpros (desktops) and Systempros (servers) are a good example. Then we saw the development of different lines for specific distribution channels: direct-market, computer-superstore, and mass-merchant products.

More recently, vendors have given



PCs represented
(clockwise from
upper left): Gateway
2000 VESA Local-Bus
Line, DECpc ST,
Eitech Splendor, Tri-
CAD VL-Station, AST
Advantage! Plus TLC,
Compaq Deskpro/L.

Photographs by Robert Cardin

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up on trying to segment their products by channels and now more often organize product lines based on intended users: office/high-performance, office/standard-performance, small office/home office, and home PCs. For example, the AST Bravo LP line of compact PCs is positioned for entry-level home-office use; the AST Advantage! Plus TLC units for small-business use; and the top-of-the-line AST Premmia PCs for high-end business use.

Simple, huh? Just pick the line aimed at your needs, then pick the right model within that line? Well, not exactly.

Some vendors have incredibly cluttered and confusing lines that overlap. IBM for instance has five separate PS/1 lines targeted toward different markets, as well as ValuePoint and Ambra lines, with similar features and prices, apparently aimed at the same buyers.

The most exasperating aspect of today's market is that some manufacturers' lower-cost lines actually out-perform

their high-end lines. For example, Acer America Corp.'s mid-price ISA-based AcerPower 486v line did better in some of our tests than its more expensive EISA-based AcerPower 486e machines. This kind of paradox occurs because vendors churn out new products about every six to nine months. At times a lower-price line has been redesigned with more up-to-date components than its more expensive older sibling.

Nonetheless, the development of

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product lines has its place: Distinct computing needs call for distinct classes of PCs. We organized the reviews along PC lines, and arranged them alphabetically by manufacturer. Some may question our choice of 486s or better for this Buyers' Guide, and others probably will wonder about our requirement for at least 16MB of RAM and a 300MB hard disk. After all, you could save about \$500 by buying a less-ambitious configuration. Ours is as much a model configuration for tomorrow's users as it is for today's most demanding users.

We're convinced that 486s are the sweet spot in the PC market today, a choice that will keep you happy for the next few years. Buying less could be a mistake. With complete 486 PCs selling for close to \$1,000, just slightly above 386 prices, saving a few dollars doesn't make sense. Most of the cost of a system is in the other components—case, motherboard, floppy and hard disk drives, video, monitor, memory, keyboard—so that the

incremental savings on 386s are out of proportion to the price paid in reduced horsepower.

You could move up to a Pentium, and undoubtedly many buyers will, as more Pentium PCs become available and their prices fall. But just as the savings in moving down to a 386 today are too small to justify the loss in power, the added cost of moving up to a Pentium is for most too large for the performance gained.

Only Digital Equipment Corp. submitted a Pentium PC, even though several other vendors, including Compaq and IBM, had lines that extended to Pentium. Digital's Pentium/60 DECpc ST, as expected, dominated many of the benchmark test categories—first place in processor, DOS disk, and Disk WinMark scores; and second in Winstone score—but lagged in DOS video and Graphics WinMark tests, showing that thoughtful design is as important as a hot CPU.

We asked for at least 16MB of RAM in these machines, despite this past summer's run-up in memory prices. Our experience with today's applications, and operating systems and environments, persuades us that 16MB is necessary and worth the price.

Windows itself gobbles up memory. Adding performance-improving software cache programs like SmartDrive and running Adobe Type Manager gobbles up more memory. Open three or four applications and start switching among them, and unless you have enough real, physical memory installed, Windows is going to start using its virtual memory scheme to swap code to and from the hard disk—slowing performance to a crawl.

Why throw away the speed you sought when buying a new PC, by crippling it: 4MB of RAM may be what Microsoft says you need, but we consider 8MB a minimum; 16MB is a more comfortable amount. It is likely that 16MB will soon become the standard. Indeed, several PC lines already have 16MB of RAM as standard.

Similarly, the 300MB minimum hard disk size we specified reflects the realities of today's personal computing environment. Falling prices (now near \$1 a megabyte) and increasing application sizes have combined to make the larger hard



EDITORS' CHOICE

- Comtrade EISA VL-Bus Professional
- Dell OptiPlex MXV

The exceptional level of features, quality, and performance displayed by the 89 product lines that compose this Buyers' Guide came as a refreshing sur-

prise—particularly in light of the recent PC price declines. The bottom line of four months of testing, examination, and evaluation is this: All but a handful of the tested systems are capable of meeting the computing needs of the average business or home user.

But that's not enough. To receive an Editors' Choice award, a product must demonstrate general excellence, and show that it can perform consistently across a range of processors and that it is equipped to meet—or exceed—the more stringent computing requirements we foresee for the future. Therefore, our Editors' Choices are personal computers that are likely to excel over the long run.

We give Editors' Choice awards to two PC lines—the Dell OptiPlex MXV and the Comtrade EISA VL-Bus Professional—that stand out in terms of performance and features. In addition, two lines—the Dell Dimension XPS and the Personal Computer Graphics Turbo Burst—deserve honorable mention as solid values.

BEST OVERALL:

The Dell OptiPlex MXV is the closest thing we've seen to a personal computer without compromises. It's a system that packs a lot of power into a small-footprint case. In nearly a clean sweep of the testing phase, the 486DX2/66, 486DX2/50, and 486DX/33 OptiPlex MXVs took top-ten positions (two of which were first place) on five of our seven benchmark tests. The DX2/66 OptiPlex MXV led the pack in DOS video and performed well on Graphics WinMark tests. These systems are a win-win choice for those who require full-bore computing in both DOS and Windows.

BEST WINDOWS WORKSTATION:

The Comtrade EISA VL-Bus Professional struck us as a fully optimized Windows workstation that led the entire testing group in Windows-based testing. The high-end 486DX2/66 member of the Comtrade family took a top-ten overall position with its Disk WinMark, Graphics WinMark, and Winstone scores, and it took the eighth overall spot for processing ability under Windows.

The system's only failing was a subpar DOS video score—a result of using the Weitek's Windows-intensive Power 9000 graphics accelerator for the video subsystem. The combination EISA/VL-Bus system offers the best of both bus worlds: high throughput of the EISA bus architecture and graphics potential of VL-Bus. The Comtrade family of PCs will meet the broad demands of Windows-only users.

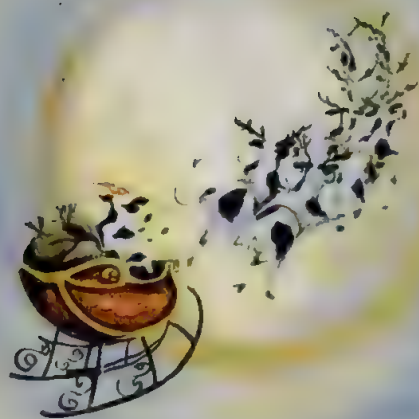
HONORABLE MENTION:

Two PC families warrant honorable mentions:

The Dell Dimension XPS family—the latest iteration of the value-oriented Dimension line—carries system prices that may seem high at first glance. A closer look, however, shows these systems to be good buys for the money: The 486DX/66 includes a double-speed CD-ROM, sound card, and 15-inch monitor; and it never shortchanges the buyer on performance.

The 66-MHz PCG Turbo Burst system from Personal Computer Graphics Corp. is a combination ISA/VL-Bus system that doesn't scrimp on performance. It produced the best Winstone and Graphic WinMark results of all 191 tested systems.





HIGHLIGHTS

The 486 Buyers' Guide

"VALUE" IS TODAY'S WATCHWORD, with many fully equipped 486 PCs available for about \$2,000. The 191 PCs here show that cutting corners on design or components can result in reduced performance and lack of flexibility. The best PCs are those that provide good all-around performance and have the features and expansion potential that make them perfect for tomorrow.

THE PC BUSINESS remains a buyer's market, with quality, performance-oriented systems available at bargain prices. The trend toward more for less should continue in the coming months as prices of present models are reduced and new lines undercut existing price levels with higher performance.

BENCHMARK TEST SCORES provide an accurate representation of a system's performance under both DOS and Windows. Results are useful for making comparisons prior to purchasing a system—and for optimizing it later on.

DX2 PROCESSORS RULE; Intel's 486DX2/66 was the most popular processor here. Eighty-three of the 89 lines had a 66-MHz system, giving buyers top performance at a reasonable price.

THE PENTIUM SHOWS PROMISE, but its impact will be felt next year when

production comes on line and prices drop. Pentiums provide a nearly two-fold performance boost, but even the 60-MHz Pentiums are too expensive to challenge the 486 family of chips.

CACHE YOUR CHIPS and system performance will increase. At the processor level, seek at least 128K of external cache for an SX- or DX-based PC. For a clock-doubled PC, shoot for at least 256K. Here, systems with 1MB of processor cache did the best.

WELL-KNOWN NAME BRANDS are no longer at a major price disadvantage. Value-oriented lines from AST Research, Compaq Computer Corp., Dell Computer Corp., IBM Personal Computer Corp., and other vendors offer performance and features one step from the top of the PC ladder at greatly reduced prices.

A LOCAL BUS combined with an ISA or EISA expansion bus is the choice of today's generation of PC designers. Video and hard disk performance are enhanced by eliminating the major bottleneck from these vital subsystems.

LOOK FOR EXTRAS that increase system value without raising the price. At one extreme are systems in the Dell Dimension XPS line, which come with CD-ROMs and sound boards. At the

other extreme are units in the NEC Image 486 Series, which feature everything on the motherboard, including I/O-port, SCSI, and network circuitry. Also, many systems include a 16550 UART (Universal Asynchronous Receiver/Transmitter) and can meet the Environmental Protection Agency's Energy Star requirements.

OUR BASIC TEST configuration—a 486 processor, 16MB of RAM, and a 340MB hard disk—may be more PC than your style of computing requires. Your choice is simple: Either downgrade to what you actually need and pay about \$500 less than the prices listed here, or spend the money now and forget about having to upgrade these parts of your system tomorrow.

PC MAKERS ONCE divided their lines into desktop and network categories. Recently, they segmented products based on distribution channels. Now, most divide their lines based on intended use. Current categories include office/high-performance, office/standard-performance, small-office/home-office, and home PCs.

THE SWEET SPOT of the PC market is the 486. Go down to a 386 and you'll see reduced performance. Move up to a Pentium and the extra cost will overwhelm any performance benefits.

disks standard for workstation use. These seemed suitable only for network servers until just a couple of years ago.

With disk requirements measured in tens of megabytes, it doesn't take many Windows applications to consume several hundred megabytes of disk space. And data files written by today's applications often take up a surprisingly large space—especially when you start pasting graphics into them. Add a few dozen fonts, and a 100MB to 200MB hard disk, which once seemed like a bottomless pit, gets pretty crowded. After all, you're buying a new PC to meet your require-

ments today, a year from now, and even further in the future. By then, even a 300MB disk may look very small, indeed.

Mirroring this era of expanding hardware requirements, our new batch of benchmark tests strives to compare today's—and tomorrow's—PCs. We rewrote the original DOS processor, video, and disk test suites; and two Windows test

suites—Disk WinMark and Graphics WinMark. We also introduced Winstone 94, Version 1.0, a Windows-based applications test. Winstone 94 runs 12 popular Windows programs through a predetermined script, and parallels DOSmark as a measure of application performance.

Exemplifying their positioning as today's mainstream personal computers,

Our Contributors: OLIVER RIST is a staff writer at *PC Magazine*. BRUCE BROWN, JOHN R. QUAIN, and JIM SEYMOUR are contributing editors at *PC Magazine*. MIKE FEIBUS heads the MicroSystem Group of MicroDesign Resources and is a freelance writer. BRIAN NADEL was the associate editor in charge of this story, and TAMI PETERSON was the project leader.

AUSTIN has what DELL wants for Christmas.



It's true.

"Dell Computers — and others — had a great idea: produce a compact notebook with blazing speed and a large capacity hard disk.

Sounded good to us. Only difference is, we made it happen! Our Ultimate Notebook features a 66 MHz processor with a 340 MB hard drive — something Dell just cannot seem to deliver.

But the real reason we pushed ahead with this product is because you, our customers, told us that's what you wanted. Maybe unlike some others, when our customers talk, we listen! Hope you enjoy this terrific notebook!"

David Scull, President/CEO
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- ♦ COMPAQ Color Monitor, preinstalled MS-DOS 6 and Microsoft Windows 3.1 and a COMPAQ Mouse.

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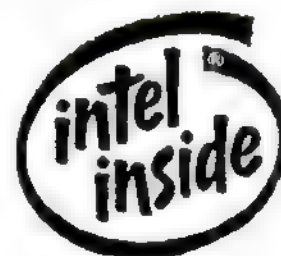
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the machines that we reviewed demonstrated most of the current important technical trends in PC design. Beyond 486s, storage space, and enough system memory, here's a checklist of items that today's PC buyer should watch for.

• **Processor.** Intel holds about 95 percent of the 486 microprocessor market, which is exactly the proportion of Intel chips in the tested group. We were pleased to see new, Intel-compatible CPU chips from Advanced Micro Devices (AMD), Cyrix Corp., and IBM that appear to challenge Intel's near-monopoly in the x86 world. But our tests suggest that for now, genuine Intel chips deliver more bang for your buck.

For example, IBM's SLC2 clock-doubled chips, unlike Intel's DX2s, are not 32-bit designs throughout. IBM's 25/50- and 33/66-MHz chips were well behind Intel chips at the same speed ratings. IBM's newest clock-doubler, the 40/80-

MHz SLC2 is actually a 66-MHz CPU running at a hyper speed, but could process data as fast as an AMD Am486DX/40 or an Intel DX/33. The Cyrix Cx486S/40, the firm's first foray into true 486 performance, yielded a chip slightly less

powerful than an Intel DX/33 (see the sidebar: "How the Chips Stack Up").

• **Expansion bus.** The reviewed machines used either the 16-bit ISA bus that dates from 1984; or the newer 32-bit EISA bus, developed a few years later by Compaq and others. We were surprised that

23 computer lines used the more complex, higher-performance EISA design. But don't attach too much importance to the EISA bus. In server applications, EISA bus-mastering cards can noticeably improve system throughput. But our general experience shows that their contribution to better performance in workstations is small, and at times was rivaled by optimized ISA systems.

With well-performing systems like the Comtrade EISA VL-Bus Professional to choose from, a 32-bit EISA bus remains a solid choice.

• **Video bus.** Taking video off the slow ISA expansion bus and moving it to its own dedicated bus is important to improving display performance. The VESA local bus (VL-Bus), which first appeared a year and a half ago, is a standard feature on three-quarters of the machines we tested. The next step in improved video-bus performance will be a move to Intel's PCI bus, which we expect will be introduced by the time you see this magazine. The first of several PCI systems will come from Gateway 2000 and IBM.

We also found in the tested PCs a wide range of today's (and occasionally, yesterday's) hot video chips, from ATI Technologies, S3, Tseng Laboratories, and Weitek Corp. Not all the magic in fast PC video lies in the chip; how that chip is implemented and supported—how much video RAM (VRAM) is provided and the quality of the software drivers included—is at least as important. Some, like Weitek's Power 9000 circuit excel in Windows video, but don't measure up in DOS performance. In general, we found the

Suitability to Task: The 486 Buyers' Guide

The **DOS applications** score reflects a system's ability to run DOS software quickly and efficiently. *Excellent* systems are those that earned top DOSmark scores on our benchmark tests from PC Bench 8.0. The DOSmark formula takes into account processor performance, hard disk agility, and DOS-based video functions.

Windows applications is a more demanding category; the rating indicates how well a system will operate Windows software. This Suitability to Task score takes into account system hardware and benchmark test results, including Graphics WinMark and Disk WinMark scores and the score each system earned on our new test, Winstone 94, Version 1.0. This application-oriented test puts the systems through rigorous runs of 12 popular Windows applications in six areas of general use. The Winstone score is a harmonic mean that reflects real-world systemwide performance.

We also give weight to the hardware factors germane to a system's design. For instance, the maximum RAM a system allows (either on the mother-

board or through a proprietary add-in card) is especially important not only for current Windows use but down the line as well—particularly if Windows NT happens to be in your business's long-term productivity picture.

Finally, we take into account a system's hard disk options and the diagonal size of its monitor; with Windows, the bigger the better.

Those systems with *excellent* ratings in this category posted stellar processor scores on our PC Bench tests and contained top-flight video controllers and fast hard disks, as evidenced by their excellent Graphics and Disk WinMark scores. Fewer systems garnered *excellent* ratings in this tough category than in our DOS applications category. But this reflects reality, as fewer systems perform as well in Windows as they do in DOS

Expandability refers to a system's potential for growth. Considerations include ease of processor and external cache upgrades, system BIOS, hard disk options, maximum RAM installable on the mother-

board and via expansion cards, available drive bays and bus slots, the presence of a flash-upgradable BIOS system, and the presence of a 16550 UART high-speed serial-port chip. The best systems have drive bays and slots to spare and easily upgradable processor/cache subsystems.

With so many factors involved, it's not at all surprising that those systems with *excellent* ratings in this category are not just towering cases but robust models designed with multiple users in mind.

The **overall value** score represents a ratio of performance per dollar paid for the machine. To determine the performance portion of this equation, we take into account the DOSmark and Winstone scores. We also lend weight to existing hardware capabilities and room for expansion. In short, the performance score represents an amalgamation of the previous three Suitability to Task ratings. We divide each system's performance score by its price to come up with a rating that will help you identify the best values.

► Product Name

SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	POOR
Expandability	GOOD
Overall value	EXCELLENT

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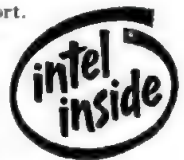
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CIRCLE 083 ON READER SERVICE CARD

■ Service & Reliability: 486 Buyers' Guide

In our 1993 Service and Reliability Survey, we sent questionnaires to 17,000 random subscribers; about half of them responded, describing to us their PC-related experiences over the past two years. We have published results only for those vendors for which we received at least 50 responses, the minimum for a statistically reliable sample. For more information about the survey methodology and its results, please refer to our July 1993 issue.

Readers rated vendors on a scale of one to ten in three categories: Overall Reliability, Satisfaction with Repair Experience, and Satisfaction with Technical Support. Based on our readers' responses, we gave each vendor a composite rating of *significantly above average*, *average*, or *significantly below average* in these three areas.

TECHNICAL SUPPORT scores are a measure of how quickly and thoroughly the vendors' telephone support services met the respondents' expectations.

RELIABILITY scores indicate to what degree PC owners felt their systems met their overall expectations for consistent operation.

REPAIR SERVICE scores are culled from those users who contacted the manufacturers to have their PCs repaired. The scores reflect users' satisfaction with the service they received.

best compromise between DOS and Windows display performance to be subsystems built around the Tseng ET4000/W32 chips. For more information about video adapters see the companion story in this issue.

• **Processor cache.** Backing up today's high-performance processors with sizable second-level (L2) external instruction caches is the key to delivering truly fast CPU performance. For example, the four machines tested that were equipped with 1MB of cache—the Aberdeen Super EISA VLB (DX/33 and DX2/66) and Hi-Tech Super EISA/VLB (DX2/50, and DX2/66)—led their respective processor classes, often besting systems with more capable CPUs.

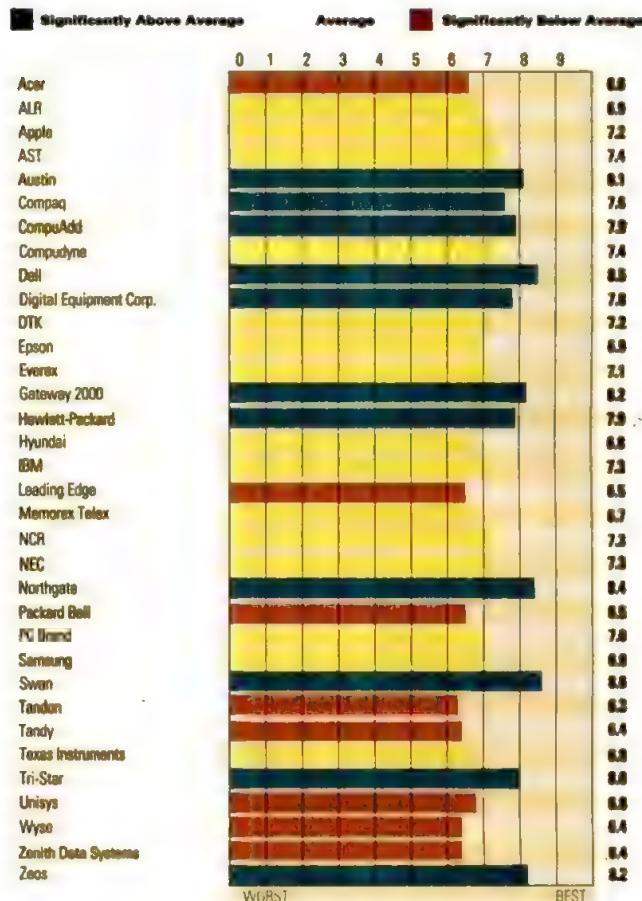
Most other units submitted had 256K of L2 cache memory, such as the Compaq Deskpro/M. The DX2/66 Deskpro/M came with 256K of L2 cache, and ranked

fourth overall in processor performance. But none of the other Compaq models—Deskpro/i, ProLinea, and Presario—had any external cache; their processor scores were mediocre at best.

We should note that the new PC Bench 8.0 tests exercise external caches much more than did earlier versions. In the past, benchmark tests fit neatly within 64K caches, making this level of cache look better than it might otherwise have. That was then: The new processor test suite uses a large mix of code and data that doesn't fit inside 128K or 256K caches, reducing the "shelving" effect at those two points, and exploiting much larger caches, where available.

• **Extras.** Look for seemingly small features that are part and parcel of today's PCs and add little or nothing to the cost. If you need reliable high-speed data transmissions, look for a 16550 UART

Satisfaction with Technical Support



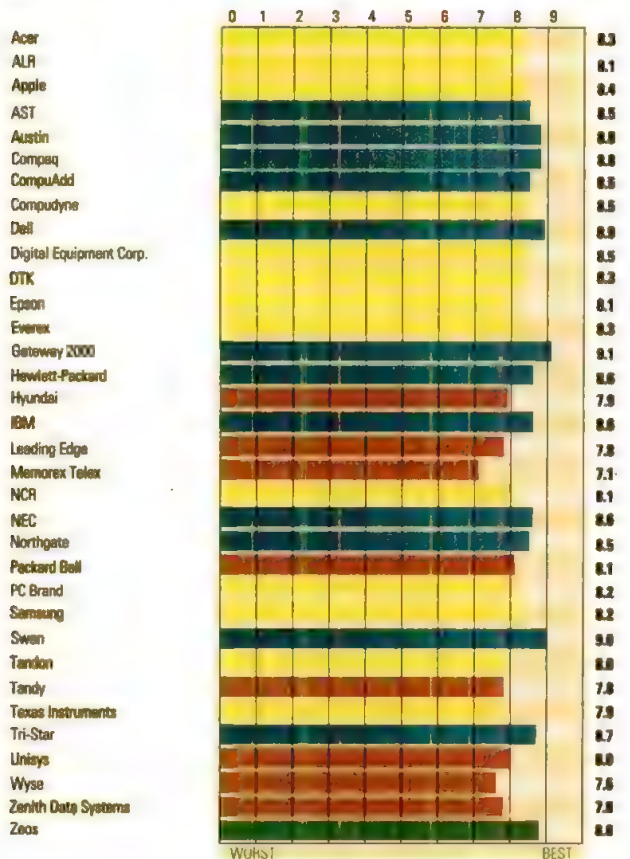
(universal asynchronous receiver-transmitter) to control the serial ports. One-quarter of the PCs tested had this feature.

The addition of a motherboard SCSI host generally doesn't add to the tab, but allows you to daisy-chain up to seven peripherals, from a CD-ROM to tape backup units. Models in the NEC Image 486 Series integrate SCSI, networking, and most other I/O function onto the motherboard. That leads to more reliable and economical systems, and much easier connections and upgrades for users, PC managers, and network technicians.

And many of the systems reviewed meet the Environmental Protection Agency's Energy Star criteria for low-power PCs. Because it uses less electricity, an Energy Star system could save you nearly \$100 per year for a continuously operating PC, and contribute less to air pollution from the power plant.

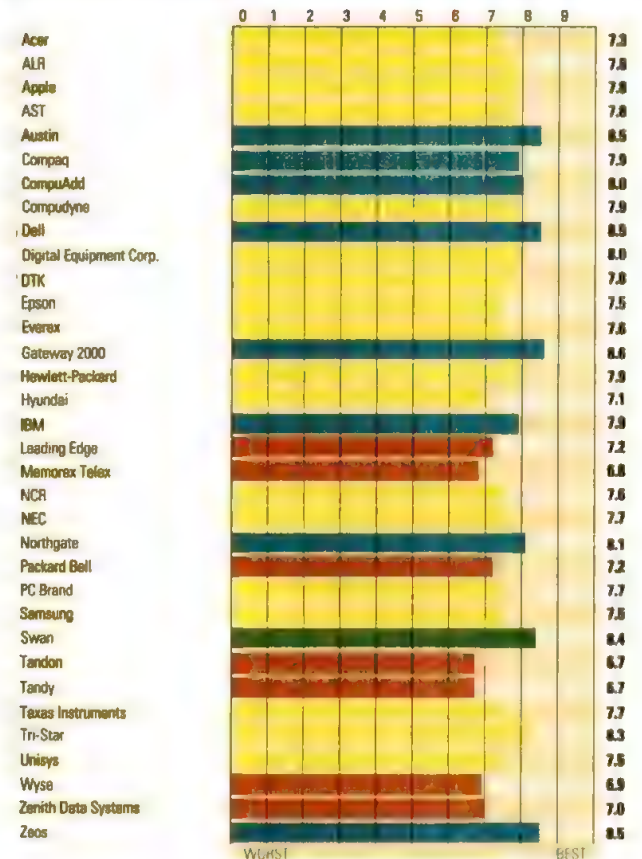
Overall Reliability

Significantly Above Average Average Significantly Below Average



Satisfaction with Repair Experience

Significantly Above Average Average Significantly Below Average



GOOD AND BAD BUILDS

We noticed a much wider design and construction quality range in these machines than we've seen in other recent tests. Ruggedness, solidity, and attention to detail are hard to quantify—but that doesn't mean they're not important. As a class, the PCs we reviewed from Compaq, Digital, HP, NCR, and NEC demonstrated better layout and workmanship than the other machines tested.

On the other hand, unfortunately, too many of the systems we examined showed an egregious lack of attention to internal design and, sometimes, production details. Some machines were cooled by poorly placed fans. Several lacked CPU-upgrade sockets, and others, while allowing CPU swaps, didn't make it as easy as it could be with zero-insertion-force sockets (ZIF). Many systems had no external drive bays available; some

had expansion slots blocked by other components (such as a cooling fan atop a CPU) that allowed use of only three-quarter-length expansion cards.

Ergonomic considerations were also

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WE FOUND A WIDE
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RANGE OF TODAY'S HOT
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VIDEO CHIPS FROM ATI, S3,
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TSENG LABORATORIES,
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AND WEITEK.
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ignored in some designs. Cases that open with simple thumbscrews or latches are a welcome development, but too few of the machines tested used such designs. Acer's snap-together case stands out as

one of the best. Card-cages that allow removal and replacement of expansion cards as a unit are also desirable, but were rare among these machines. Front-mounted video controls are the norm today, but some units came with monitors that still had controls on the back.

If it seems harder to find the right PC today, remember that's because the range of choices is so wide, and the price so attractive. Today we pick PCs based not only on price and computing performance, but also on size, expandability, power consumption, warranty, vendors' reputations, and much more.

On the other hand, the very complexity of that range of choices makes it far more likely that by perusing the reviews that follow, plus our product comparison charts and performance graphs, you'll be able to find not just an okay machine, but one that's a near-perfect fit for you.



Benchmark Tests: The 486 Buyers' Guide

What the Numbers Mean

Good all-around PCs are not made simply by wiring fast chips to hot components and hoping for the best. Our intensive look at 89 of today's most technologically up-to-date PC lines shows that the best systems comprise well-matched parts and thoughtful design.

PROCESSOR

Digital Equipment Corp.'s Pentium-based DECpc ST stole the performance show. The only Pentium-based unit in this roundup, it nearly doubled the average processor score of the 83 486DX2/66-based systems tested. The fastest of these systems, the Aberdeen Super EISA VLB and Hi-Tech Super EISA/VLB, surpassed the same average by about 22 percent, each scoring 48.2. Their similar scores reflect their identical foundations: Both contain EISA motherboards made by Micro Center Computer and identical chip sets from Silicon Integrated Systems Corp.

Though these components made for a winning combination, the outstanding performance of these two systems had more to do with the 1MB of external RAM cache each sports. The processor tests in PC Bench 8.0 exercise RAM cache to a greater extent than our previous tests did. In addition to having a small and standard mix of instructions to stress on-chip internal (L1) and external (L2) caches, the new tests include code and data that don't fit inside 128K and 256K external caches. This results in improved performance for those systems with big L2 caches.

Of the 191 systems we tested, most have 256K of RAM cache. The four that contained 1MB of RAM cache were all top performers in their processor classes. Like its 486DX2/66-based sibling, the 486DX/33-based Aberdeen Super EISA VLB ranked first in its CPU class; among the 60 DX/33-based units tested, none equaled the Aberdeen Super's score of 25.9 on our processor tests. Hi-Tech USA managed another stellar showing, with a first-place finish for its 486DX2/50-based Hi-Tech Super

EISA/VLB; this model's score of 37.2 beat the marks of the fastest 50-MHz 486-based units we tested.

By the same token, a lack of external cache can set performance back. Compaq shipped the 486DX2/66-based Compaq Deskpro/M with 256K of L2 cache. The unit ranked fourth overall in processor performance, with its score of 47.1. But the 486DX/33 in the same line came without L2 cache and finished at the back of the entire pack, tying the DX/33-based Compaq Deskpro/i and Duracom DeskSaver 486 EISA.

The three models from Destiny Computers also had no external cache and turned in unimpressive scores. But those systems had another factor impeding their performance: IBM clock-doubled processors. The key factor here was the design of these chips, which are licensed design offshoots of Intel's 386 line and not full 32-bit processors.

With its processor score of 17.0, the IBM 486SLC2/50-based Destiny Blitz 486SLC/2 showed average performance compared with the 11 486SX/25-based systems in this roundup. Doing slightly better with the same IBM chip was the Eltech Splendor, but it had 256K of L2 cache. A similar story emerged with the IBM 486SLC2/66-based versions of the Destiny Blitz and Eltech Splendor. The Splendor model, with its 256K of cache, edged out the Destiny Blitz by a little more than a point with its score of 23.8.

The IBM 486SLC2/80-based Destiny system uses an SLC2/66 with an 80-MHz crystal. It performed at least as well as the AMD Am486DX/40-based DT 486DX Versa from Diamond Technologies. Both posted processor scores of just over 27.

DOSMARK

Though 13 of the top-scoring 25 systems on our processor tests also made the top 25 in DOSmark rankings, there was one notable absence. The Pentium-equipped DECpc ST, which ranked first overall in processor and disk performance, turned in a DOSmark score that ranked 35th overall. This low score was due primarily to the system's DOS video score of 710.6—the lowest among the 191 systems reviewed. DOS-based video usually doesn't affect a system's DOSmark score to this extent, but few high-end systems perform so poorly in DOS-based video. Behind this video malaise is Cardinal Technologies' VGA 900 card, which is equipped with an older S3 chip, the P86C924. This same card is found in Digital's 486DX2/66-based DECpc ST, which scored second to last in DOS video. Neither Digital system has local-bus video.

At the other extreme, the 486DX2/66-based DECpc LPx, with its newer S3 P86C928 chip and VL-Bus video, scored 5,510.8 on our video tests. Its processor score of 44.2 and disk score of 1,179—both of which landed in the top 25—helped secure this system's DOSmark score of 710.4 (the fourth highest among all units tested). Scoring about the same on our processor tests but a little higher on our video and disk tests were the 486DX2/66-based Dell OptiPlex MXV and Dell Dimension XPS, which posted, respectively, first- and third-place DOSmark scores. Hewlett-Packard's 486DX2/66-based HP Vectra XM, which posted a processor score of 44.2 and showed top video and disk performance, took second place overall.

GRAPHICS WINMARK AND DOS VIDEO

In terms of Graphics WinMark performance, the Weitek Power 9000 remains the video chip to beat. Of the top 25 Graphics WinMark performers, 22 contained this chip, mostly on Diamond Viper cards. But there's a twist: The system at the very top, Personal Computer Graphics Corp.'s 486DX2/66-based PCG Turbo Burst, has its Weitek Power 9000 chip on a card made by Photon called the Torpedo 9000. This combina-

tion also shipped with the 486DX/33-based PCG Turbo Burst, helping secure that model's distinction as the fastest Graphics WinMark performer of all the 486DX/33-based units here. The DX/33 turned in a Graphics WinMark score of 12.3 million pixels per second, a showing that ranked 24th and surpassed the scores of many tested 486DX2/66 units.

Two models that unexpectedly made the top-25 Graphics WinMark list were the 486DX2/66-based IBM ValuePoint and the 486DX2/66-based AST Premmia. The ValuePoint, with an S3 PS86C805 chip, posted a Graphics WinMark score of 15.5 million pixels per second. The Premmia, with an ATI Mach32 chip, managed 13.8 million pixels per second.

Based on WinBench 3.0 testing measures, these are middling Windows graphics chips. But we found that some S3 P96C805 chips outperform S3 P96C928 chips when tested under WinBench 4.0. Different weights given to graphical functions under the new test suite may explain some of this swapping of position. It's also likely that "optimized" drivers for the 928 chips tooled for the old WinBench suite aren't as effective in WinBench 4.0.

Lines that showed good video performance under both DOS and Windows were C² Micro Systems' C² Saber 486 VL family, the Dell OptiPlex MXV line, the NEC Image 486 Series, and the Tangent VL line. Systems in all but one of these families contain Tseng Laboratories' ET4000/W32 graphics processors; Tangent Computer units carry Toshiba fabrications of the same chip.

DISK AND DISK WINMARK

With disk-related functions continuing to be integral to Windows performance, the new Disk WinMark tests from WinBench 4.0 perform operations similar to those in our new PC Bench 8.0 disk tests, which exercise large portions of the drive at a time. Consequently, the two test suites correlate well. Of the top 25 disk performers, 17 made the top-25 Disk WinMark list—eight more than made the top-25 DOSmark list.

While the DOSmark score factors in all of our DOS tests, the Windows- and DOS-based disk scores are naturally independent of graphics performance.

Therefore, the Pentium-based DECpc ST, which posted number-one overall processor and disk scores, managed a clean sweep: 1,480 on our Disk WinMark tests and 1,449 on our DOS disk tests. A 524MB Quantum Pro Drive LPS525AT, along with a proprietary integrated disk controller, came with each of Digital's 11 system entries. While the controller itself has no hardware cache, the Quantum drive has 512K of built-in cache, which propelled all but the 486SX/25-based units in Digital's lines into the top half of our disk performance chart.

In general, the use of Windows SmartDrive in conjunction with a hardware cache boosted disk performance. In some cases, disk scores improved threefold with the use of SmartDrive. We also found that not all caching controllers worked effectively with all paired drives, with or without SmartDrive.

WINSTONE 94 PERFORMANCE

Our new Winstone test comes closest to replicating system performance in a real-world Windows environment. Incorporating 12 Windows programs in six different categories, Winstone 94, Version 1.0, reveals a system's ability to meet your everyday working needs. Memory size influences a unit's Winstone score more than any other single system component. Less than 8MB of system memory can drastically skew Winstone results. Since all the systems here come with 16MB or more of RAM, we could test them all on equal Winstone ground.

Given that half of the Winstone scores were 40 or higher—or roughly four times the performance of a 386DX/25-based Compaq system—there are many outstanding Windows workstations in this roundup. Because of its spectacular graphics performance under Windows, the 486DX2/66-based PCG Turbo Burst beat by a hair the Pentium-based DECpc ST.

How We Tested

In preparing this issue, we used PC Bench 8.0 to predict processor, video subsystem, and disk performance using DOS applications. The DOSmark is a summary of those three results and estimates system performance under DOS.

We also used WinBench 4.0 to obtain Graphics and Disk WinMark scores, and we used the application-based Winstone 94, Version 1.0, to determine system performance under Windows 3.1.

The **processor** score gauges the speed of a PC's processor subsystem. This test measures CPU, RAM, and RAM cache performance. The score is based on a large instruction mix and either the floating-point coprocessor test or the floating-point emulation test, depending on whether a PC uses a coprocessor.

The **video** score is a weighted harmonic mean of tests that measure 8- and 16-bit VGA write operations involving both text and graphics.

The **disk** score gauges the performance of a PC's disk subsystem, which includes the hard disk, disk controller, and any hardware or software disk caches. This test works with more than 100 files in six directories totaling over 30MB. The test includes file reads, file writes, file creation, and file deletion in a mix based on typical disk usage.

The **DOSmark** score is a composite rating derived from the processor, video, and disk test results. It indicates a PC's ability to run DOS applications.

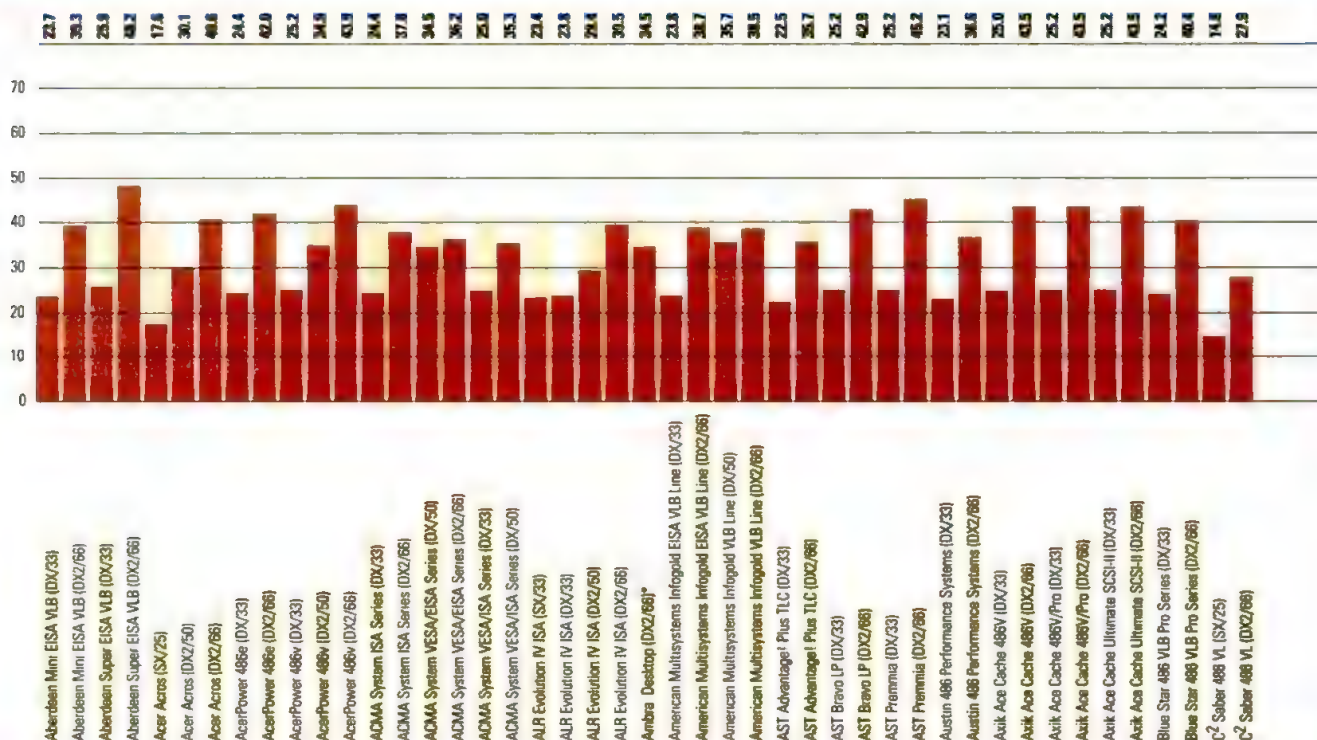
The **Disk WinMark** score reflects disk subsystem performance under Windows. The tests use different files and file operations in a blend based on extensive profiling of applications' disk usage.

The **Graphics WinMark** score is a measure of PC graphics performance under Windows 3.1. We run 66 different tests—divided into seven graphics test mixes—to evaluate a PC's handling of the Windows GDI (Graphics Device Interface). These tests are based on extensive application profiling. The scores are reported in millions of pixels per second.

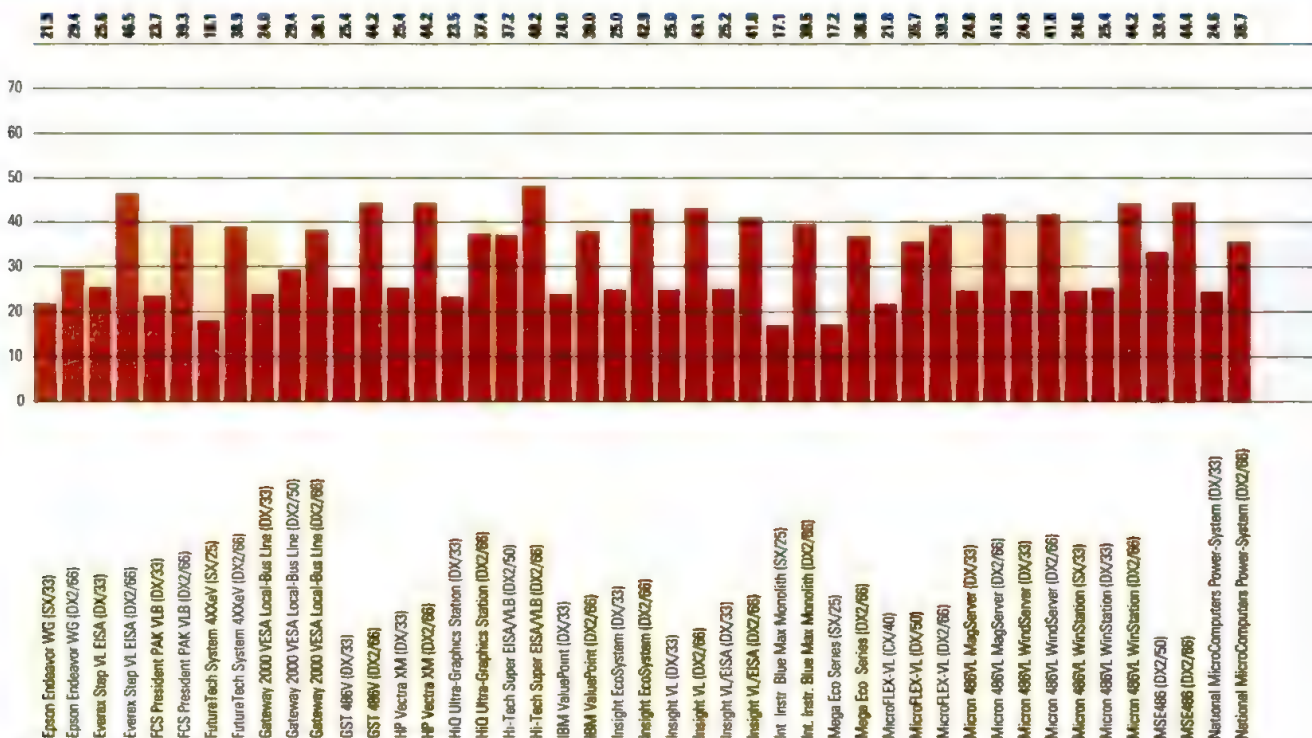
Winstone 94, Version 1.0, measures the time a PC takes to execute a set of application scripts that exercise 12 Windows 3.1 applications. Winstone scores have been normalized relative to a 386DX/25 Compaq Deskpro/M with 4MB of RAM, which has a Winstone score of 10.0.

Benchmark Tests: The 486 Buyers' Guide

Processor

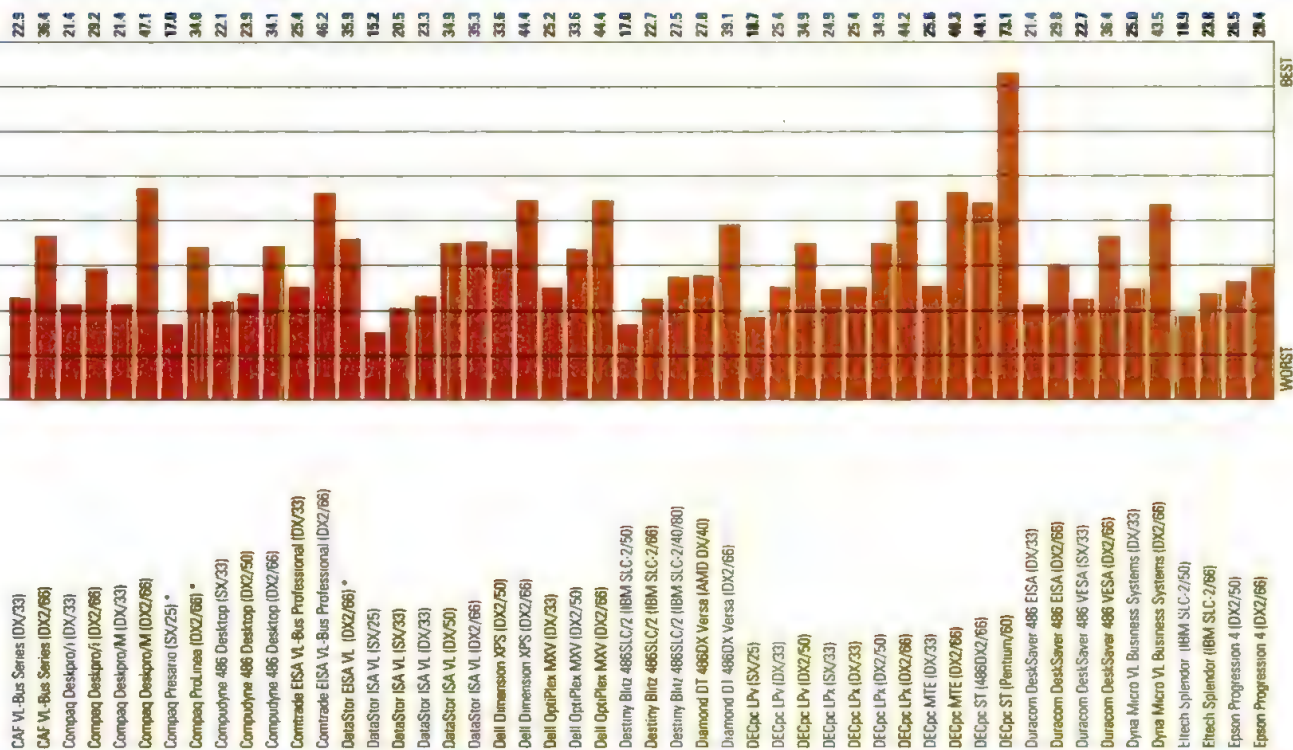
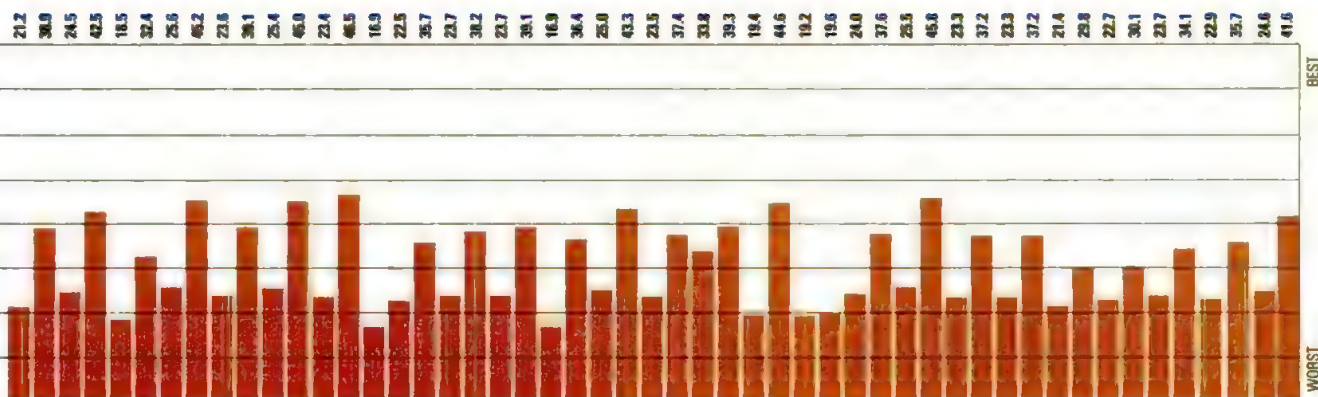


Processor (continued)



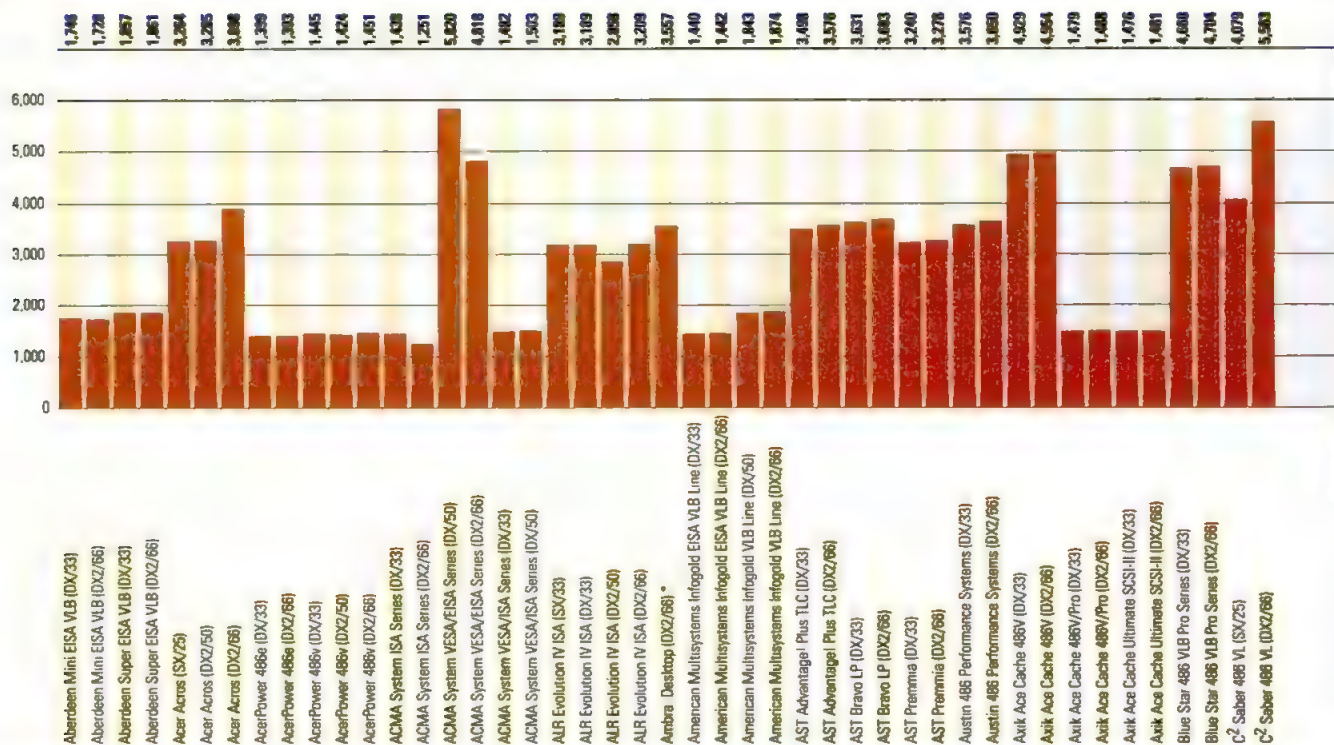
* This is the only system we reviewed from the manufacturer's line

National MicroComputers Pro-System (DX/33)
 National MicroComputers Pro-System (DX2/66)
 NCR AT Local-Bus Workstation (Desktop) (SX/33)
 NCR AT Local-Bus Workstation (Desktop) (DX2/66)
 NCR AT Local-Bus Workstation (Tower) (SX/75)
 NCR AT Local-Bus Workstation (Tower) (DX2/50)
 NEC Image 486 Series (DX/33)
 NEC Image 486 Series (DX2/66)
 Packard PowerPAC (DX/33)
 Packard PowerPAC (DX2/66)
 PGG Turbo Burst (DX/33)
 PGG Turbo Burst (DX2/66)
 Poly 486SV (SX/33)
 Poly 486SV (DX2/66)
 OTech Computers VI Series (SX/75)
 OTech Computers VI Series (DX/33)
 OTech Computers VI Series (DX2/66)
 Reason Square 4 LXPWA 486 (DX/33)
 Reason Square 4 LXPWA 486 (DX2/66)
 Reason Square 4 LXPWS 486 (DX/33)
 Reason Square 4 LXPWS 486 (DX2/66)
 Reason Square 4 LXPWS 486 (SX/75)
 Swan 486 Direct Bus (DX2/66)
 Sys Jumbo Tower-ESA-VESA (DX/33)
 Sys Jumbo Tower-ESA-VESA (DX2/66)
 Sys Medium Desktop-VESA (DX/33)
 Sys Medium Desktop-VESA (DX2/66)
 Tangent Black Box Pro Series (DX2/50)
 Tangent Black Box Pro Series (DX2/66)
 Tangent VI (CX/40)
 Tangent VI (DX2/66)
 TC VESA Video Pack (DX/33)
 TC VESA Video Pack (DX2/33)
 TC VESA Video Pack (DX2/50)
 TC Windows Workstation Powerhouse (DX/33)
 TC Windows Workstation Powerhouse (DX2/66)
 Touche ISA VLB (DX/33)
 Touche ISA VLB (DX2/66)
 Tri-CAD VI Station (DX/33)
 Tri-CAD VI Station (DX2/66)
 Unisys PW² Advantage (DX/33)
 Unisys PW² Advantage (DX2/66)
 Unisys PW² Advantage Partner (DX/33)
 Unisys PW² Advantage Partner (DX2/66)
 Unitek LB System (DX/33)
 Unitek LB System (DX2/66)
 Xinetron X1an 486 (DX/33)
 Xinetron X1an 486 (DX2/66)
 Xinetron X1an Station (DX/33)
 Xinetron X1an Station (DX2/66)
 ZEOS Upgradable (DX/33)
 ZEOS Upgradable (DX2/66)

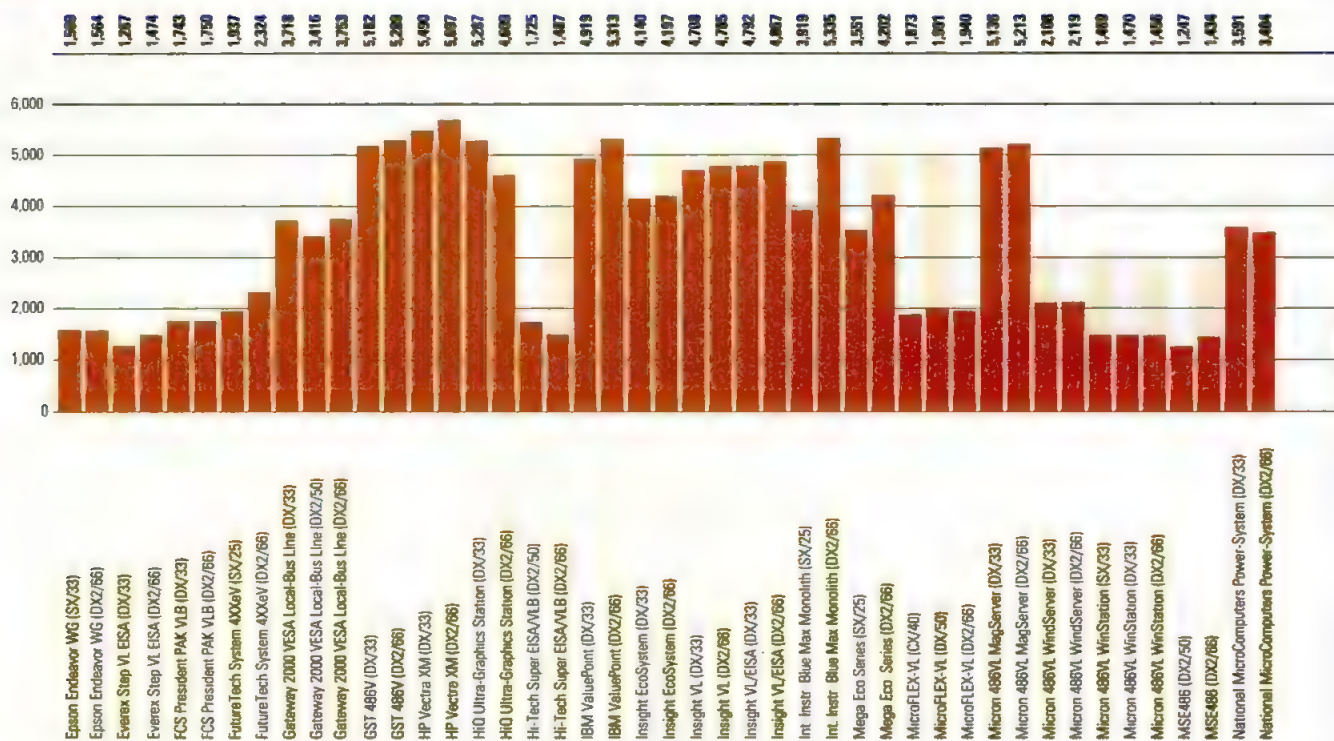


Benchmark Tests: The 486 Buyers' Guide

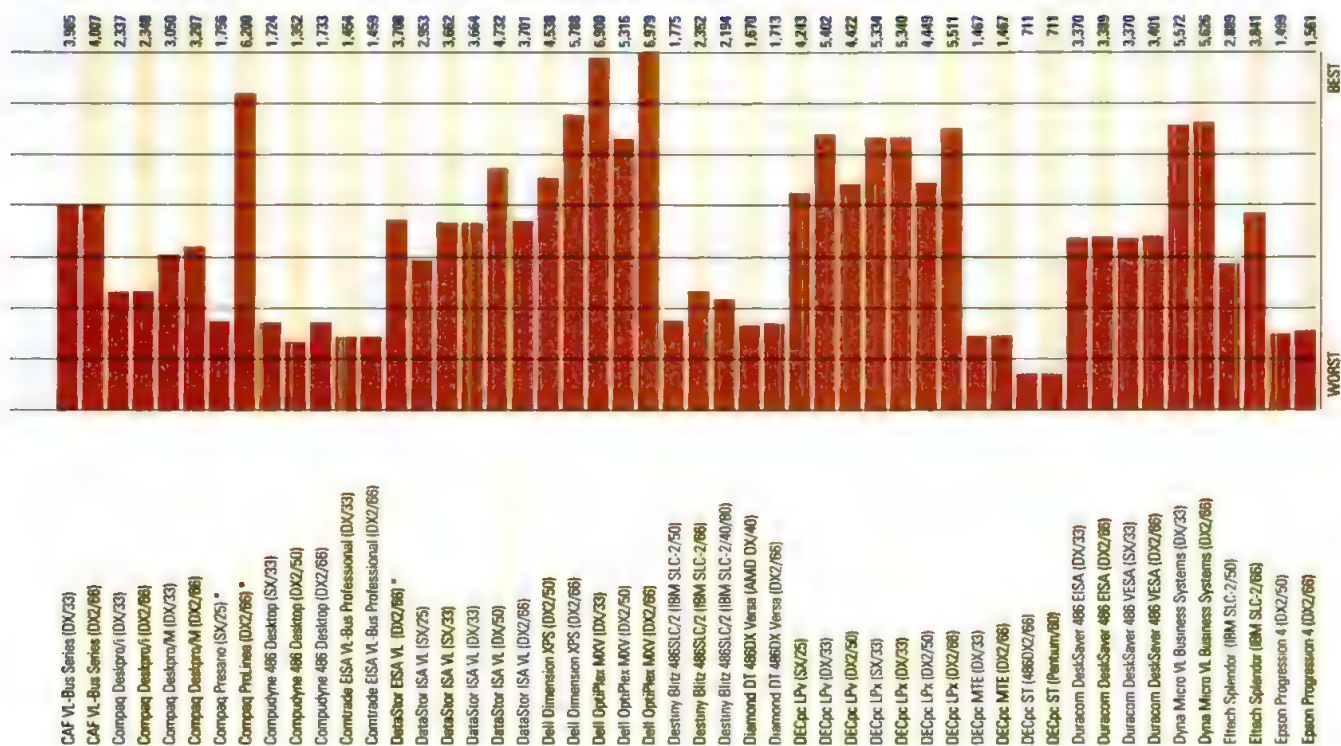
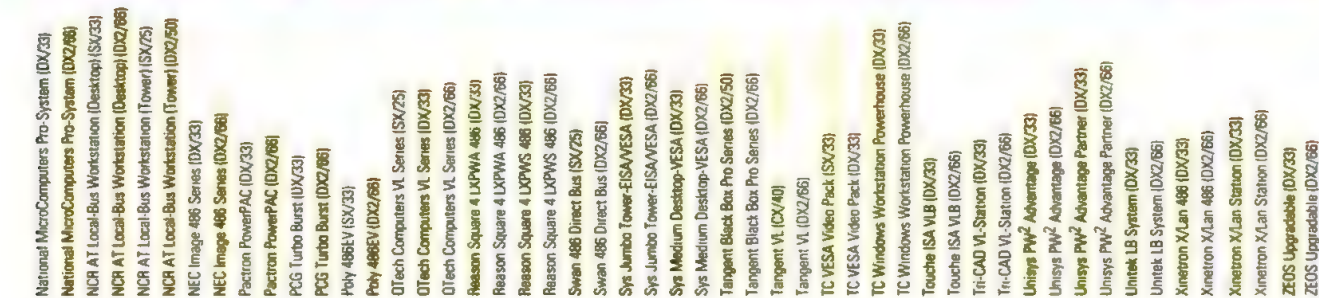
Video

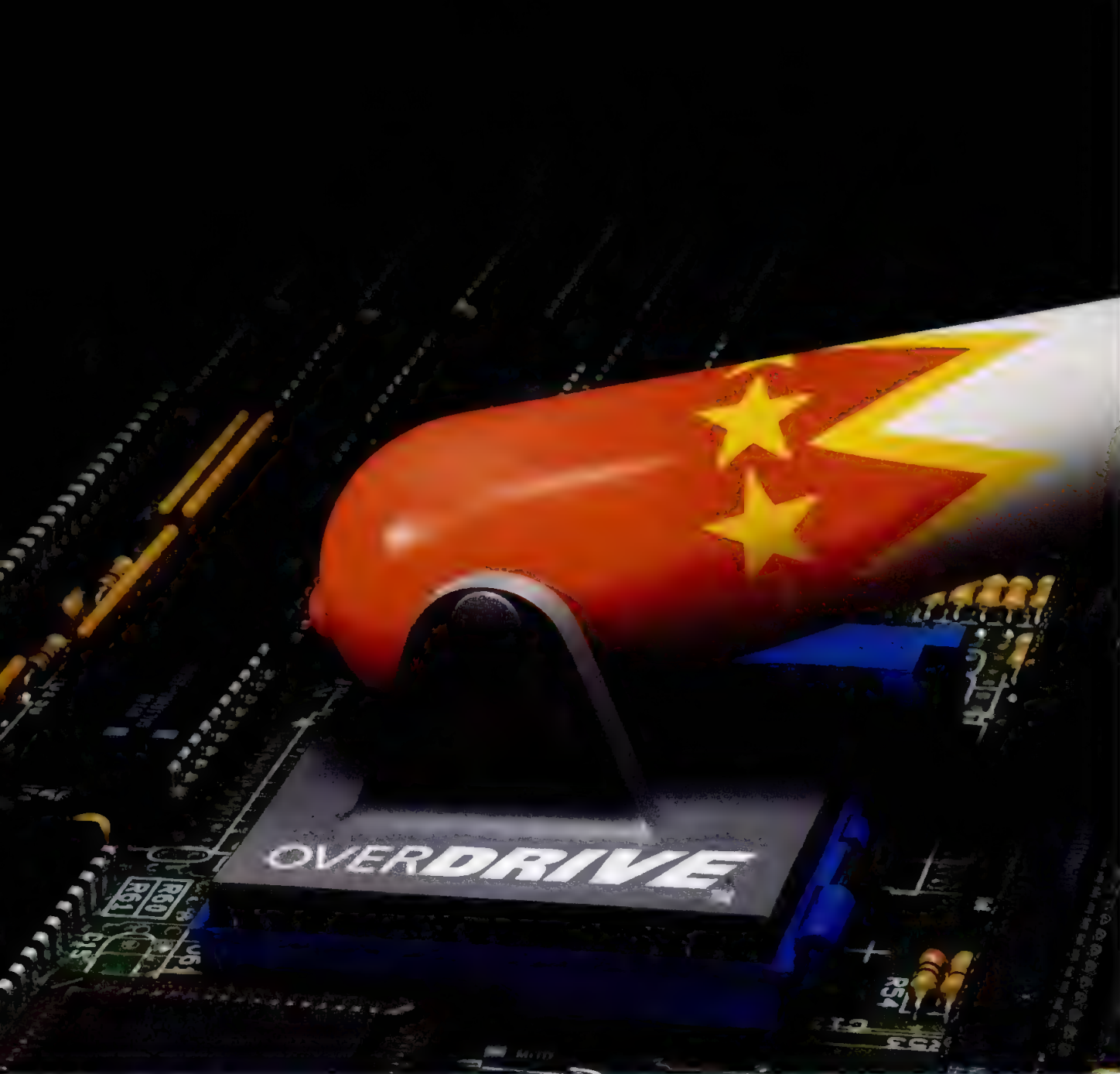


Video (continued)



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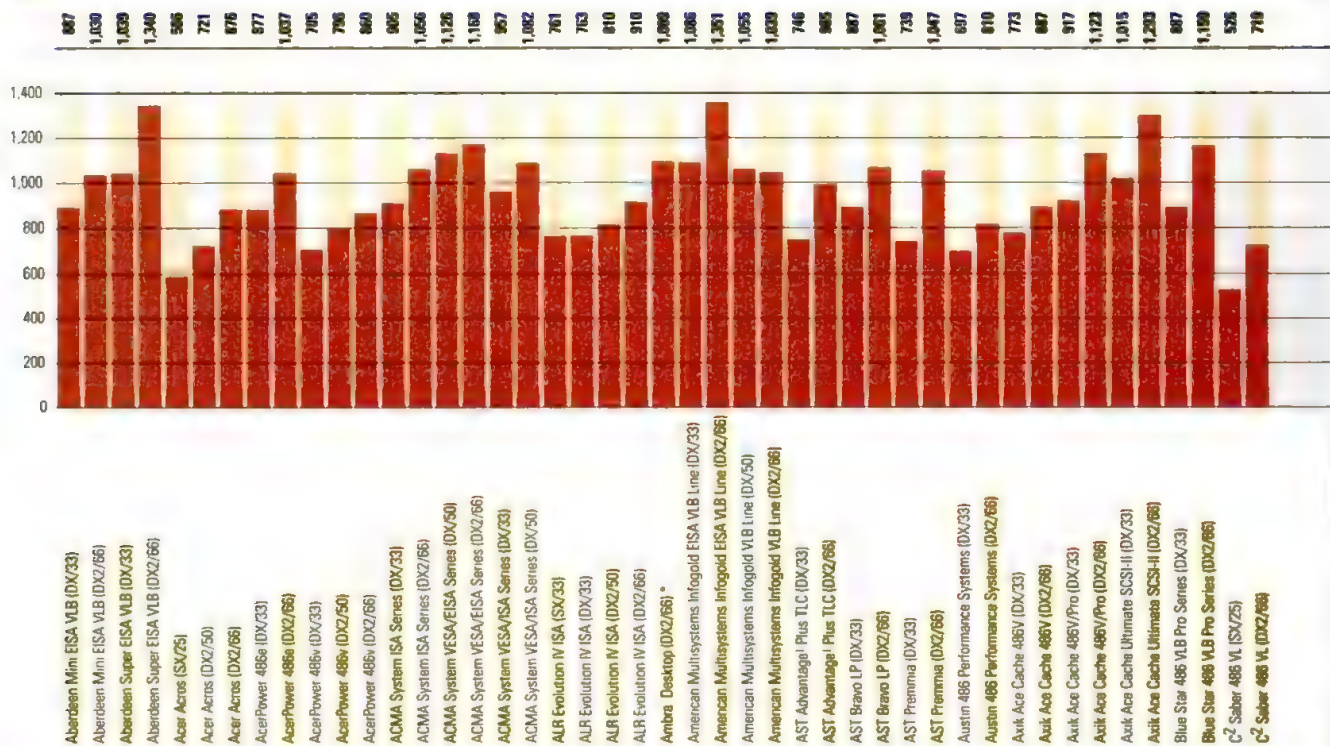
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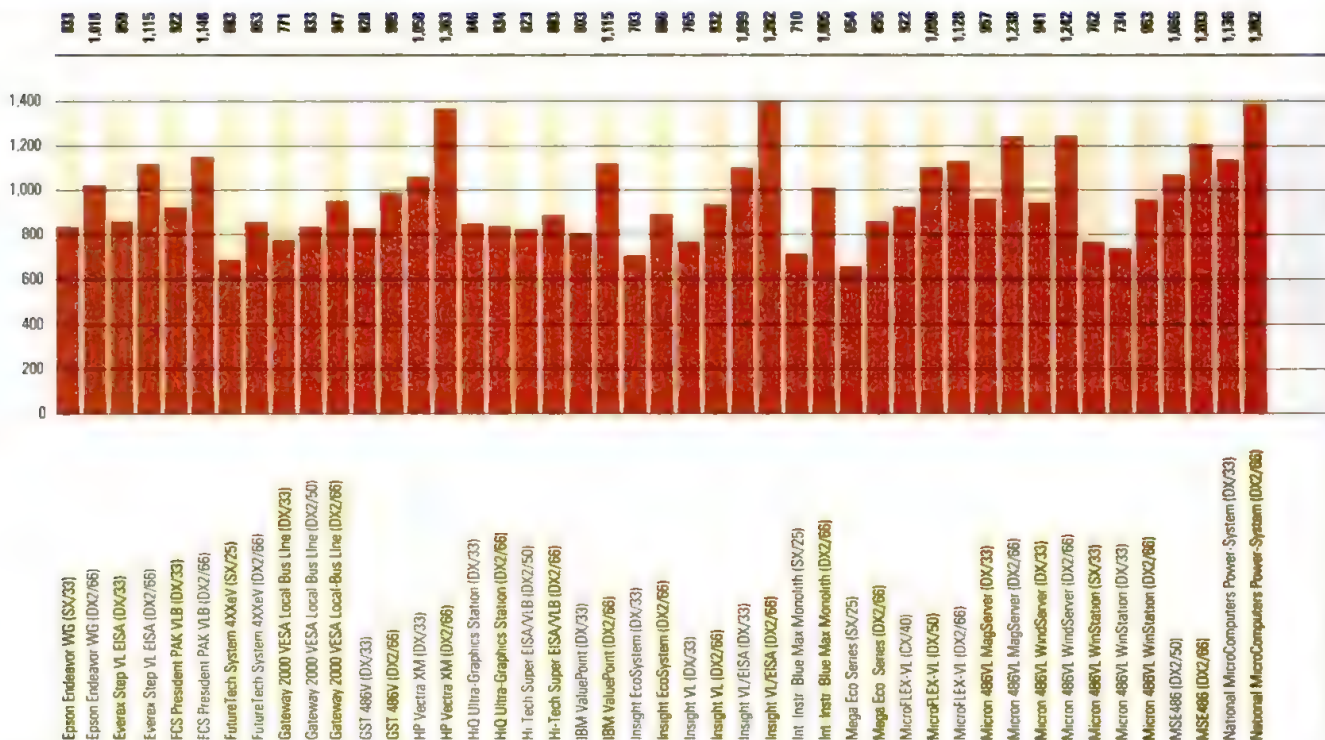
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Benchmark Tests: The 486 Buyers' Guide

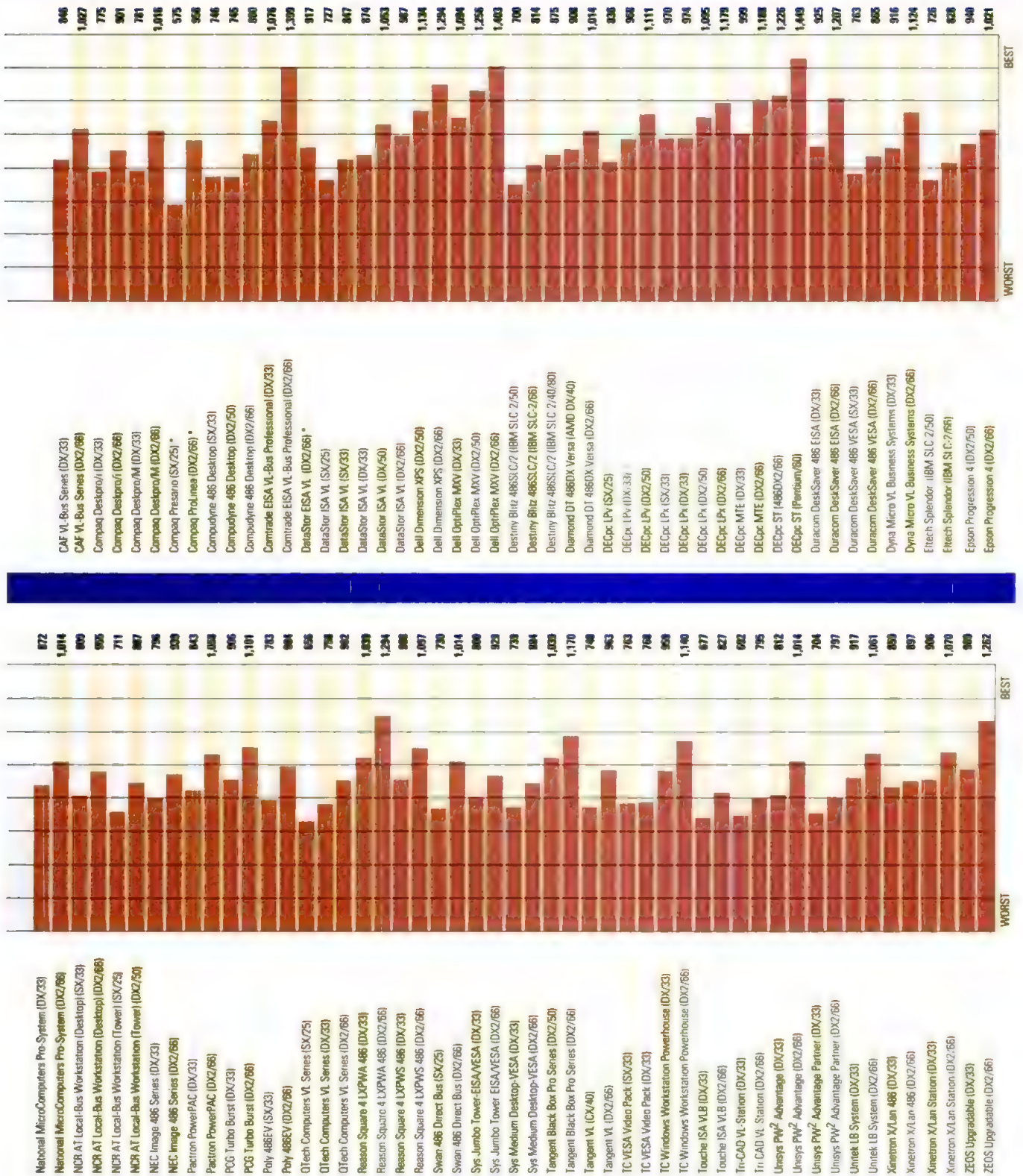
Disk



Disk (continued)

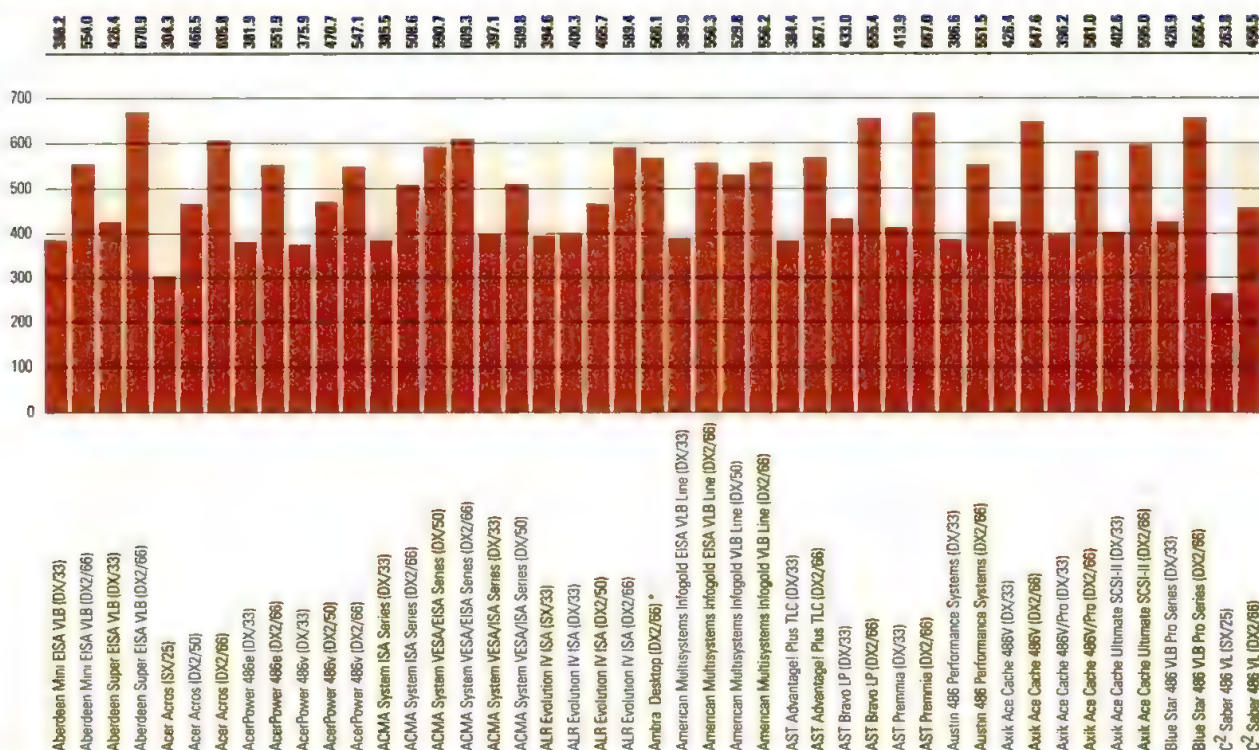


* This is the only system we reviewed from the manufacturer's line

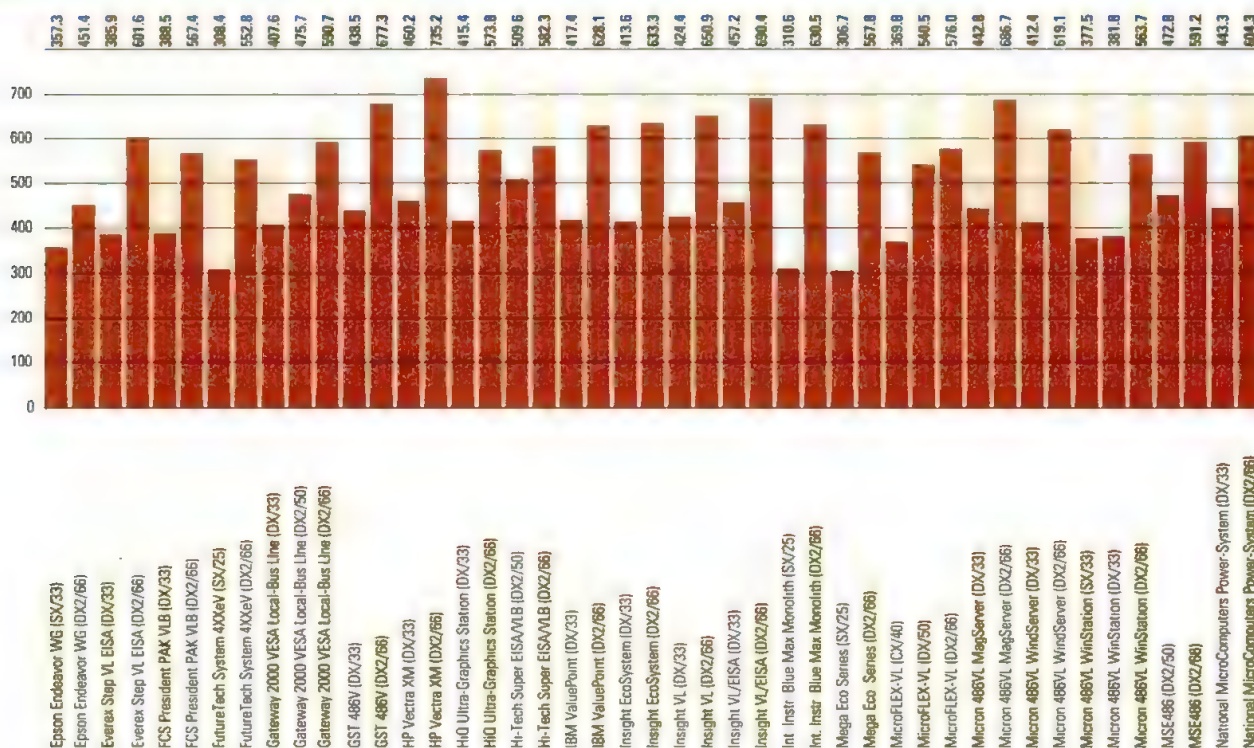


Benchmark Tests: The 486 Buyers' Guide

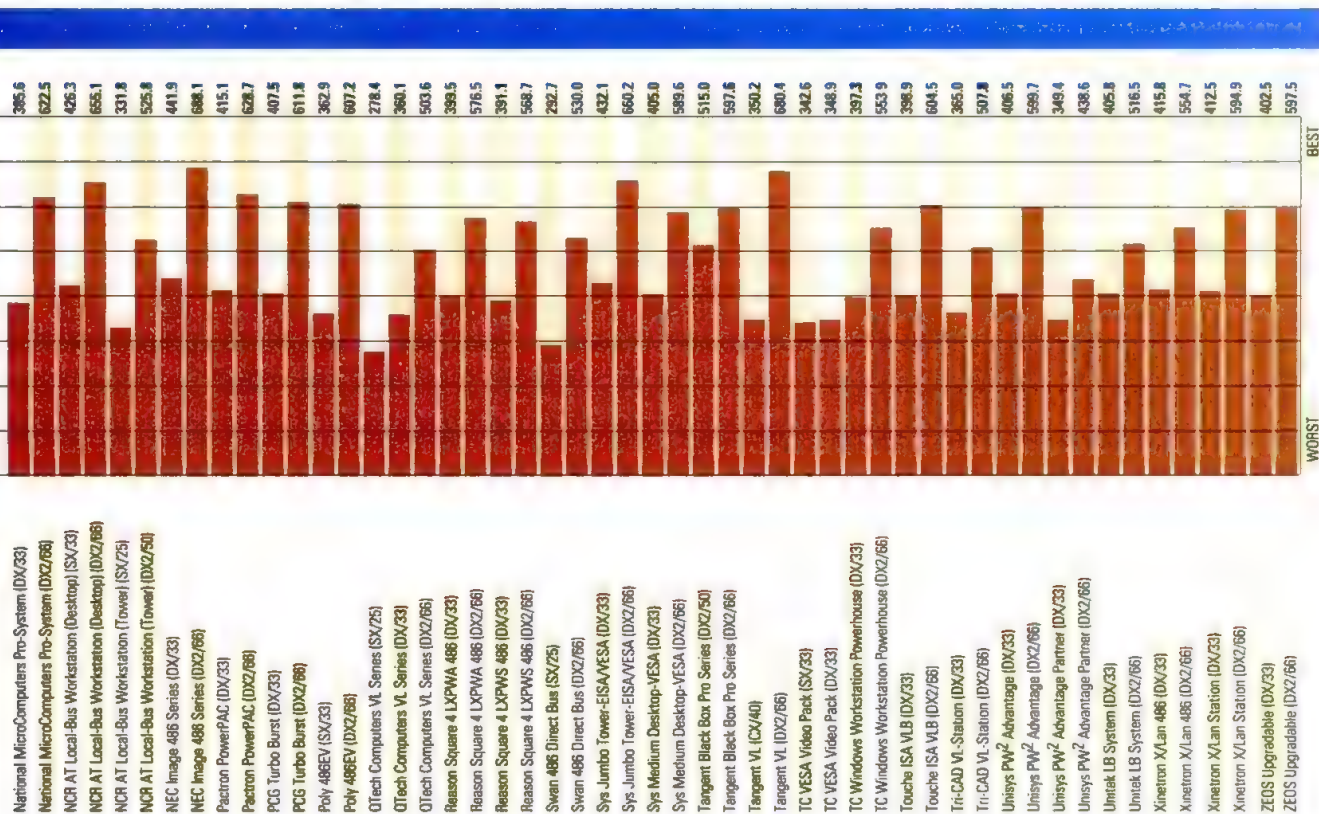
DOSmark



DOSmark (continued)

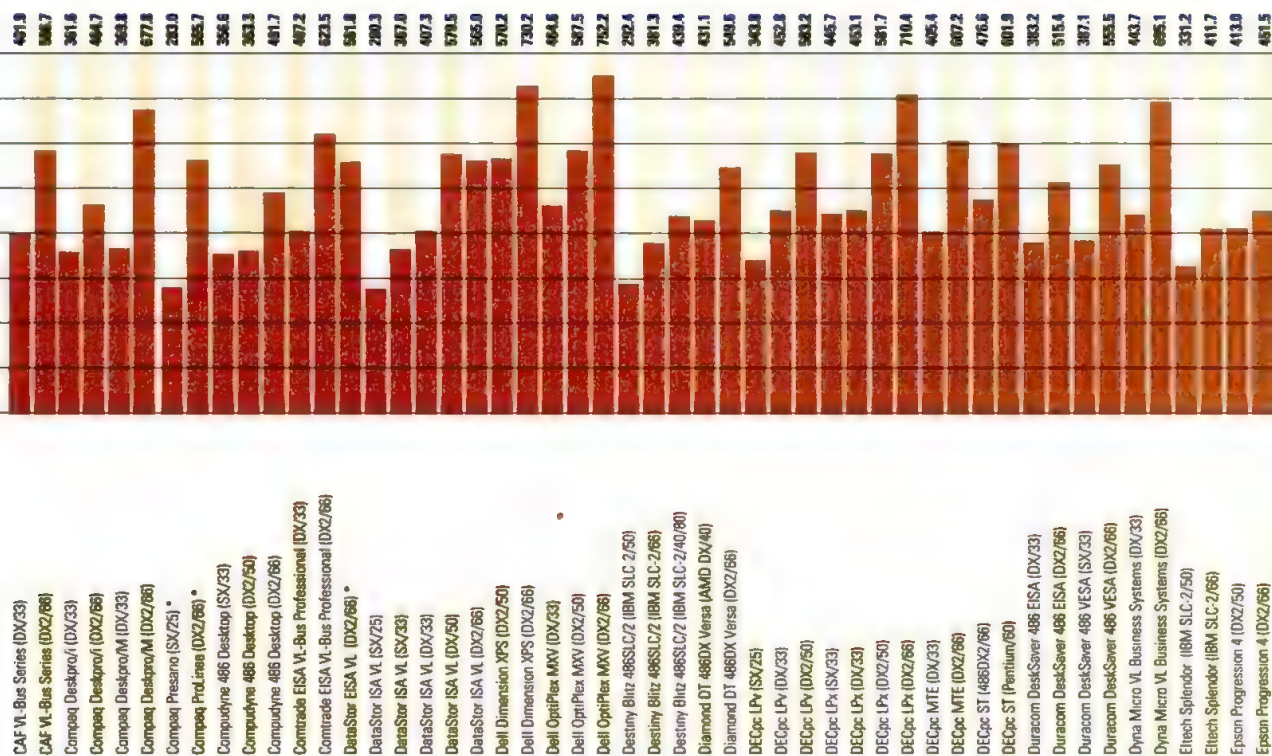


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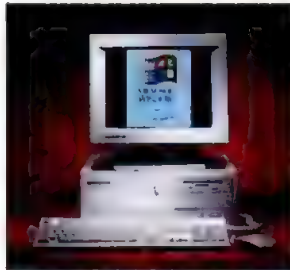


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- CMPD .39 14" SVGA
- MS-DOS 6/Windows 3.1
- Keyboard and Mouse



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66 MHz PERFORMANCE AT A GREAT PRICE: THE 486DX2/66

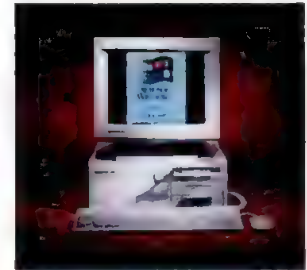
- Intel 486™ DX2/66 CPU
- 4 MB RAM
- 1.44 MB 3 1/2" Floppy Drive
- 210 MB Hard Drive
- CMPD .39 14" SVGA
- Compudyne ECS I/O VESA Local Bus Motherboard
- 1 MB Local Bus Video Card
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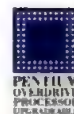


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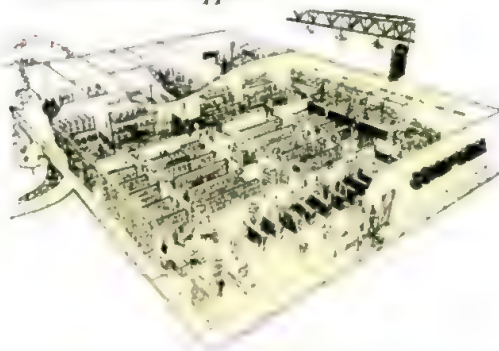
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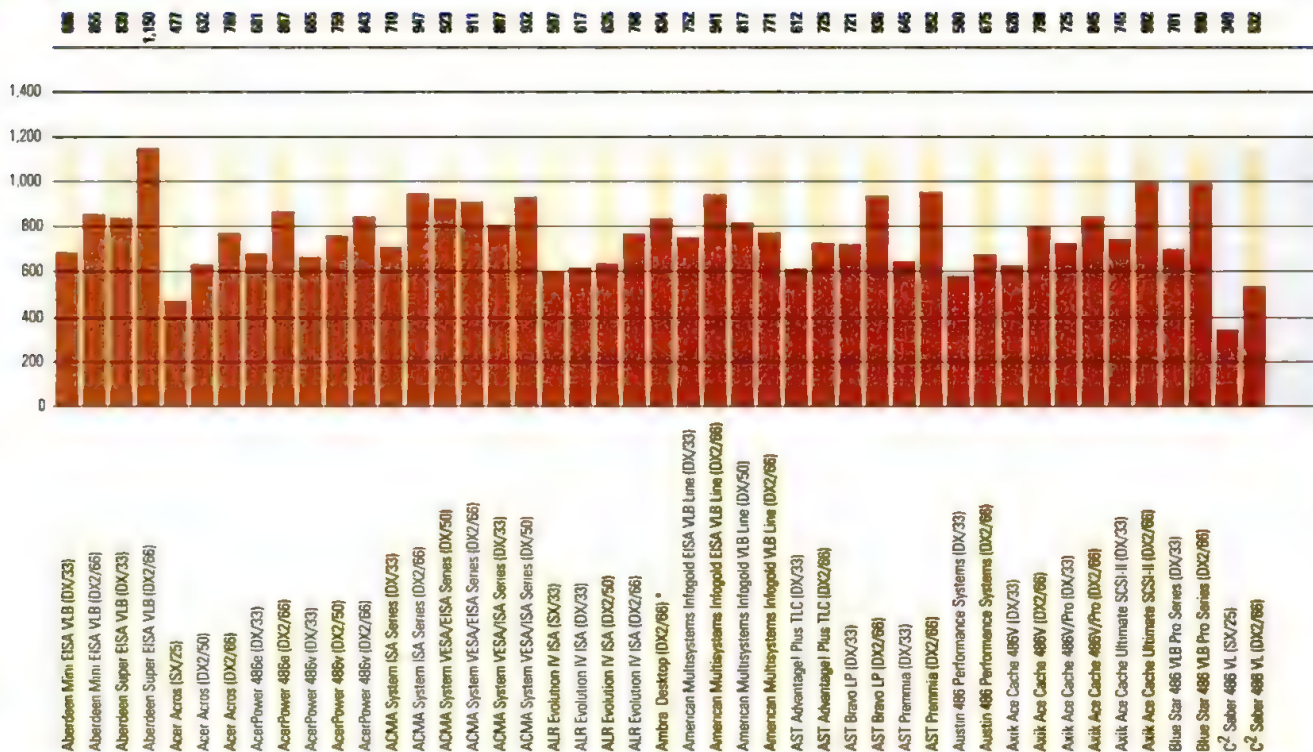
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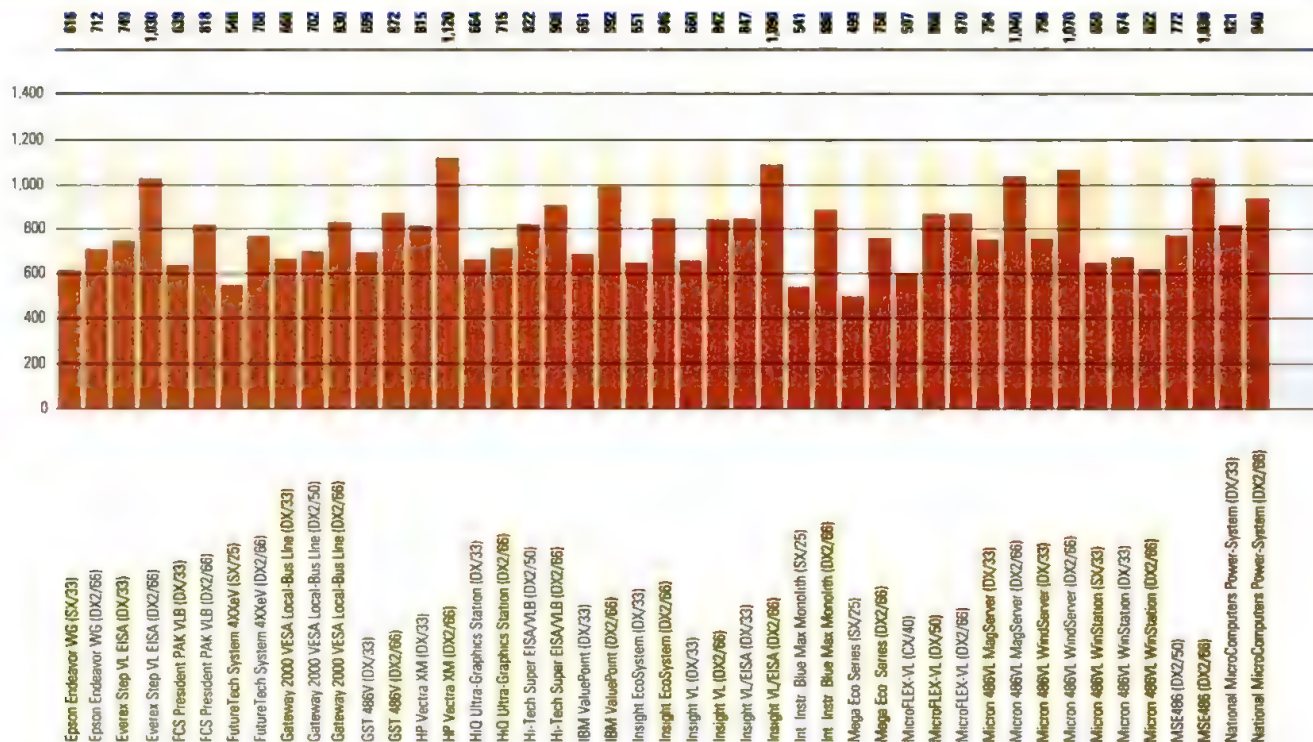
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Benchmark Tests: The 486 Buyers' Guide

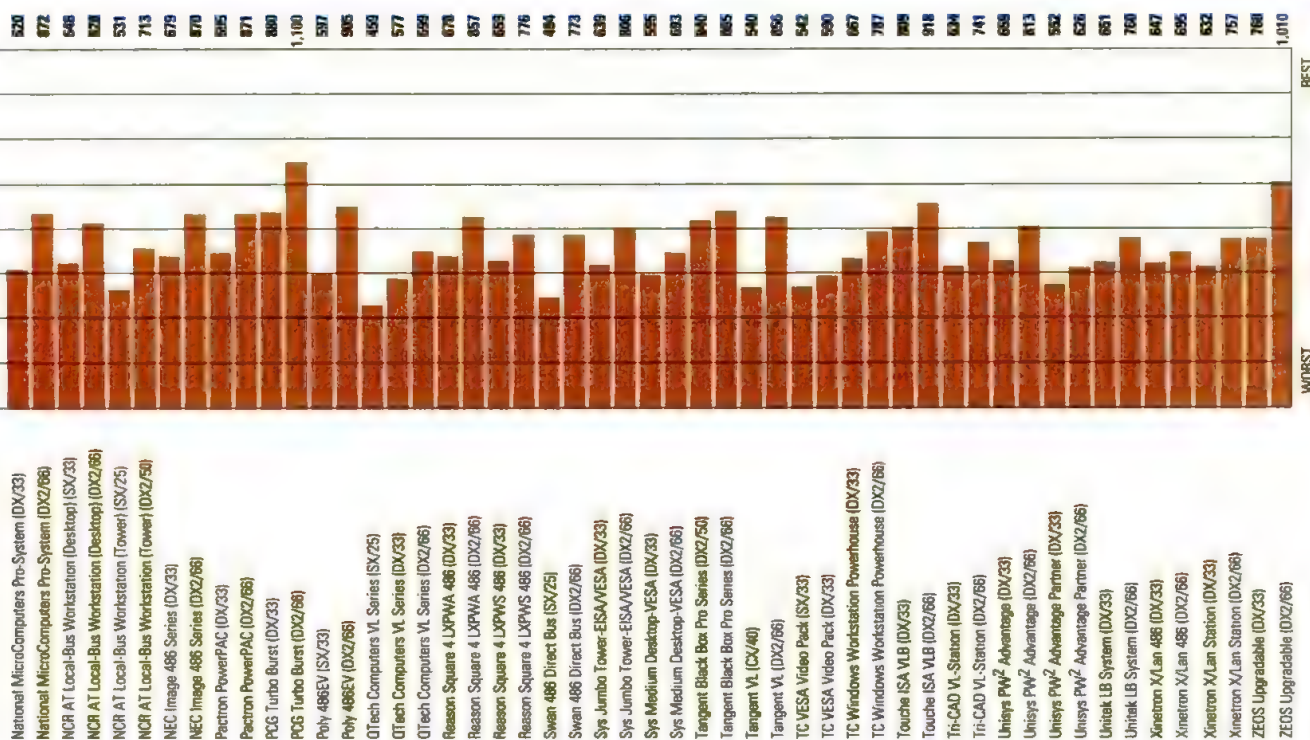
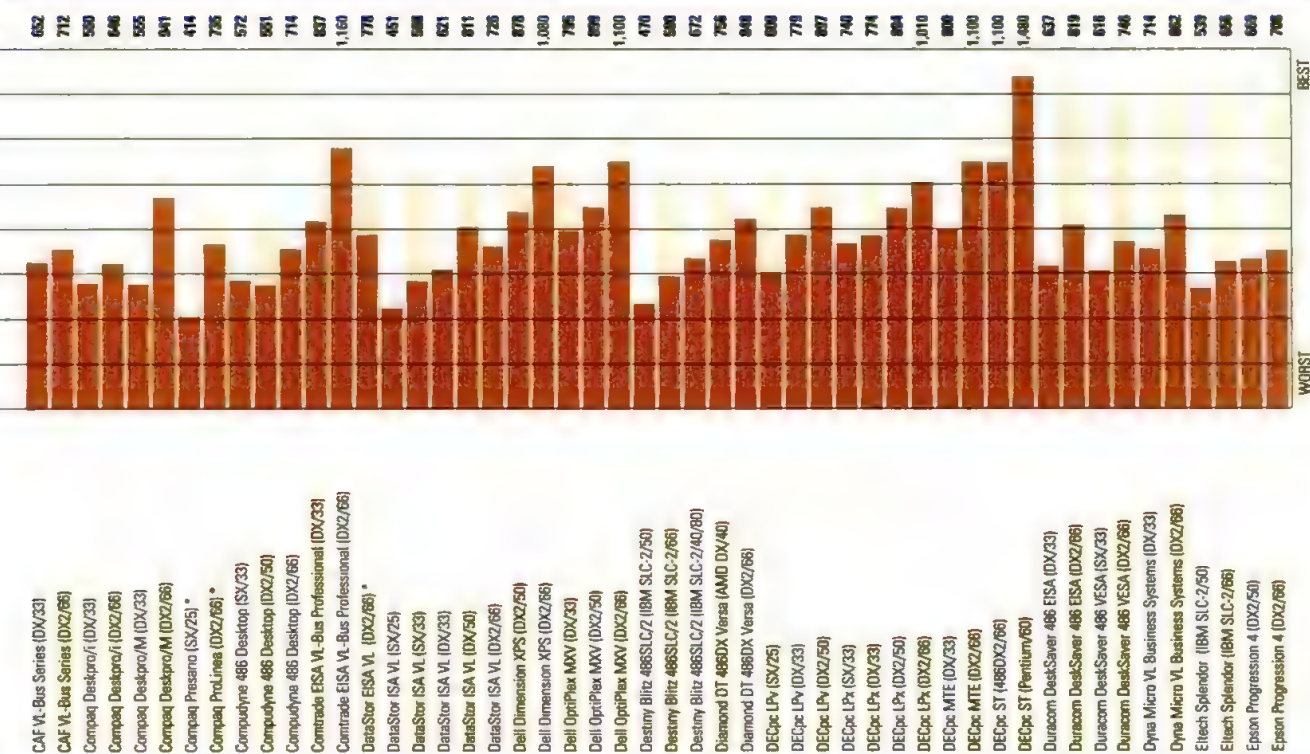
Disk WinMark



Disk WinMark (continued)

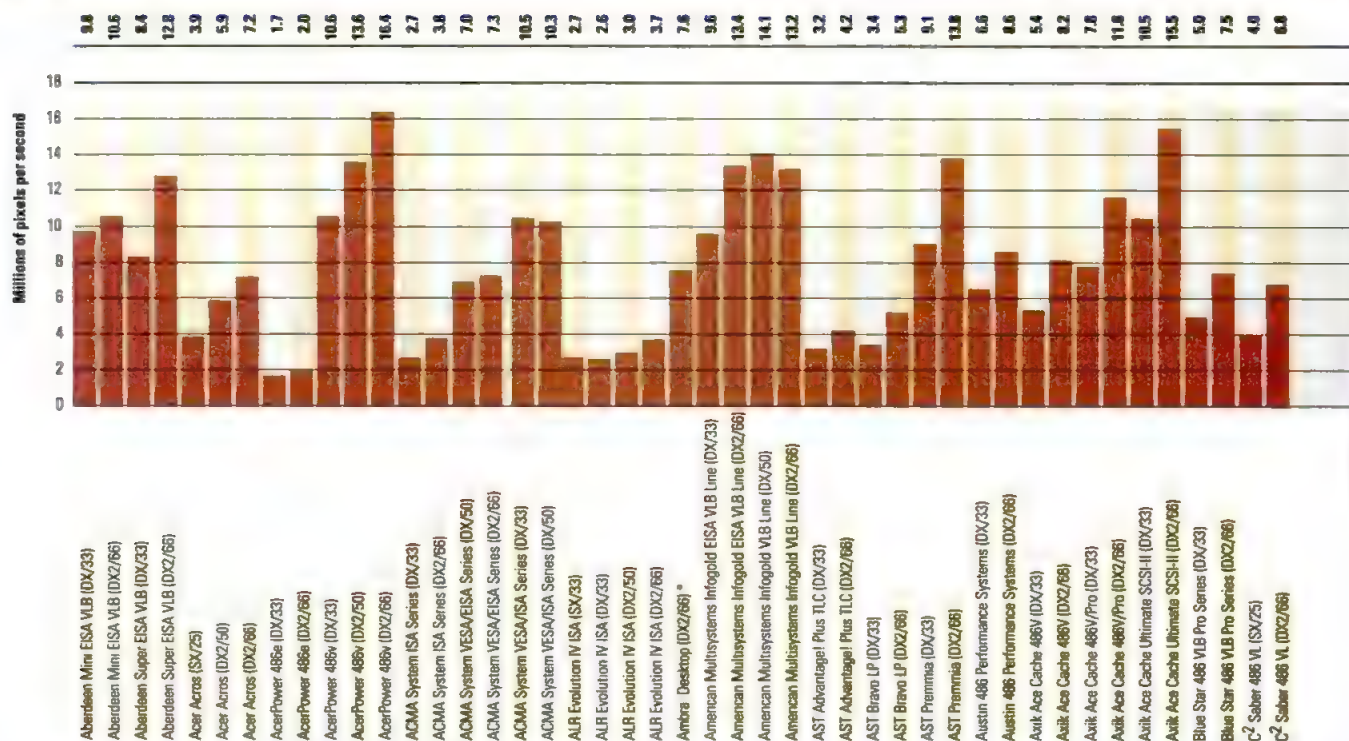


* This is the only system we reviewed from the manufacturer's line

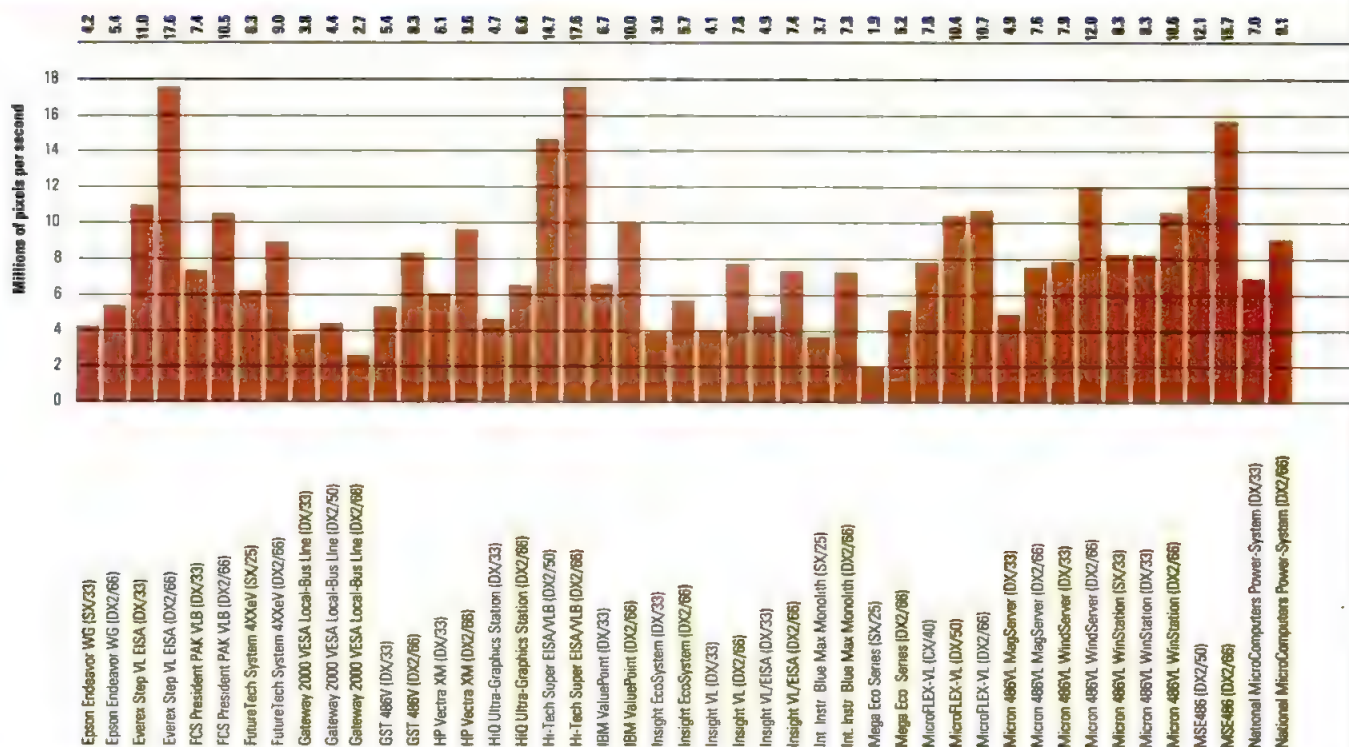


Benchmark Tests: The 486 Buyers' Guide

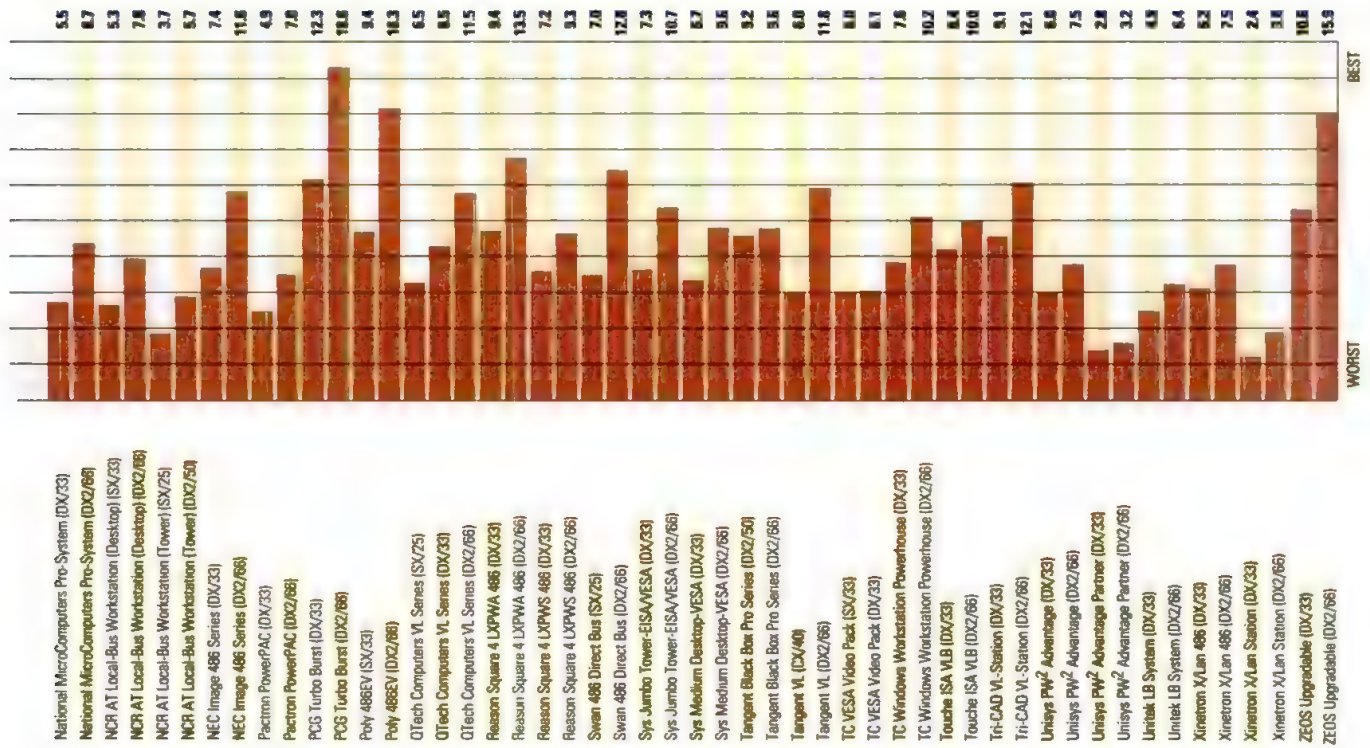
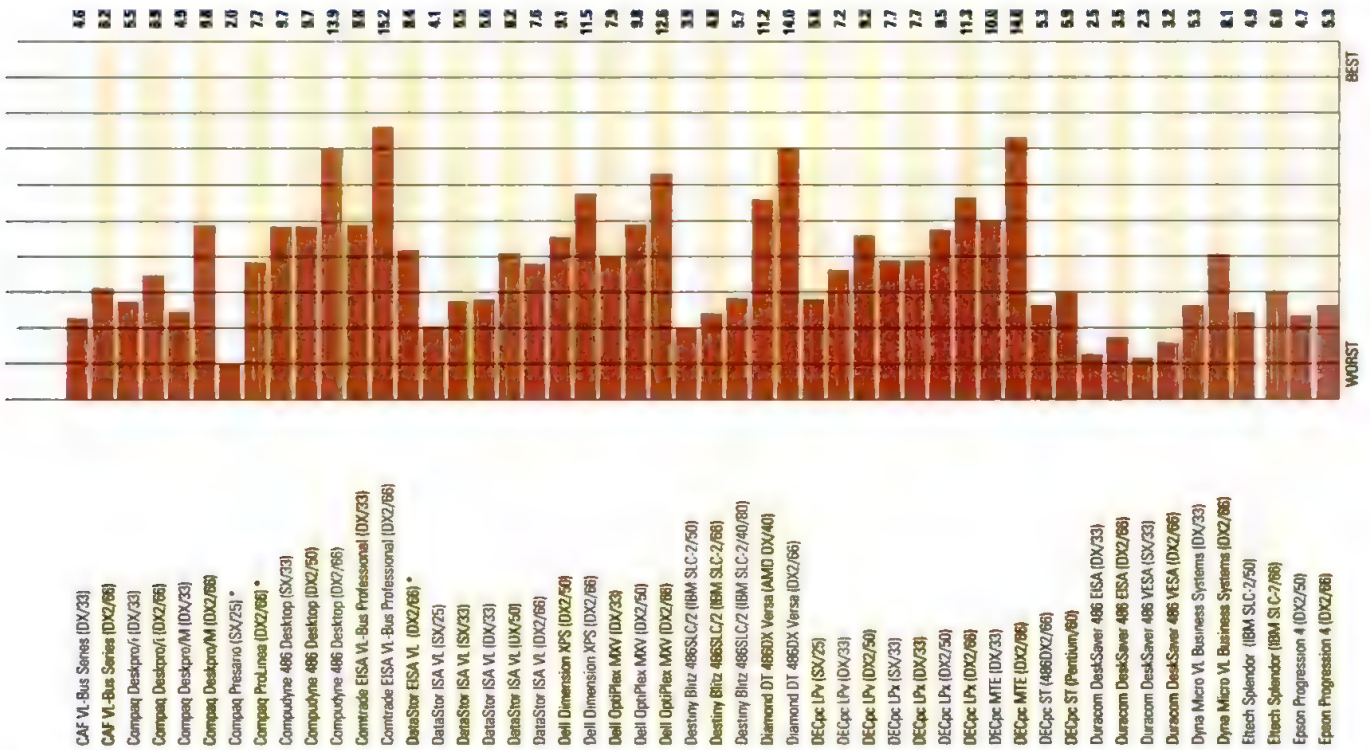
Graphics WinMark



Graphics WinMark (continued)

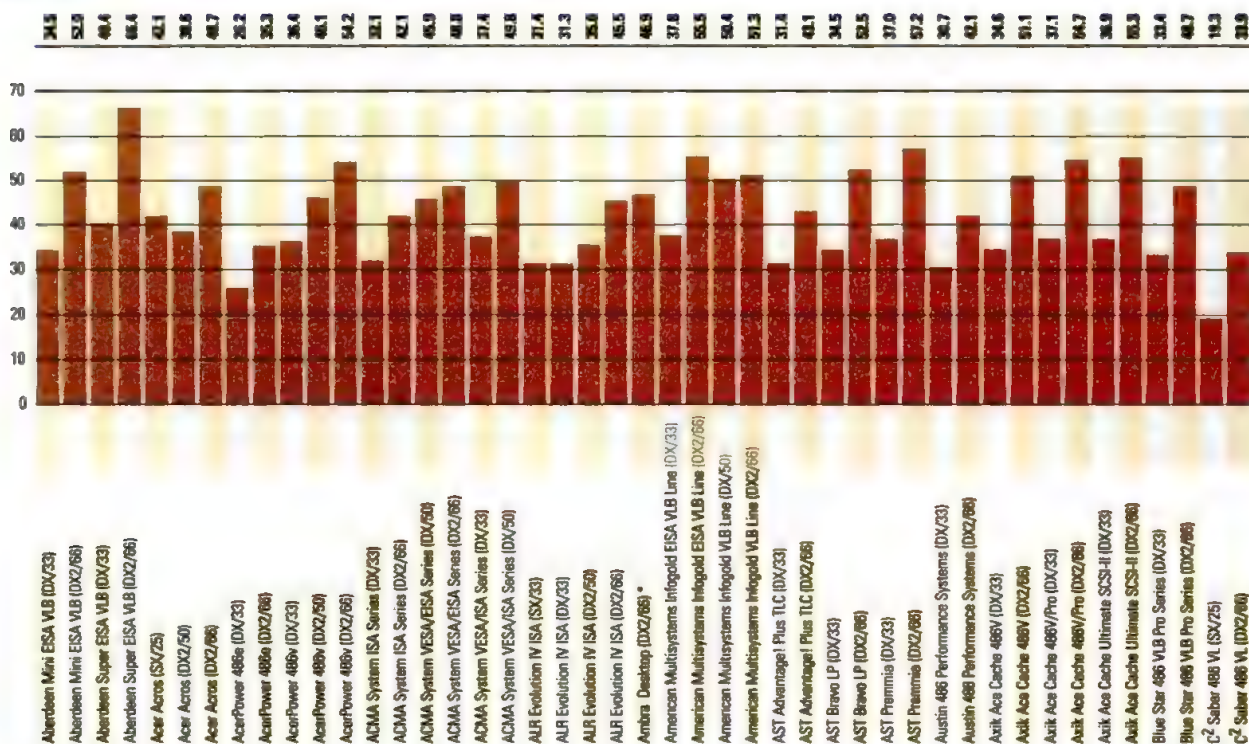


* This is the only system we reviewed from the manufacturer's line

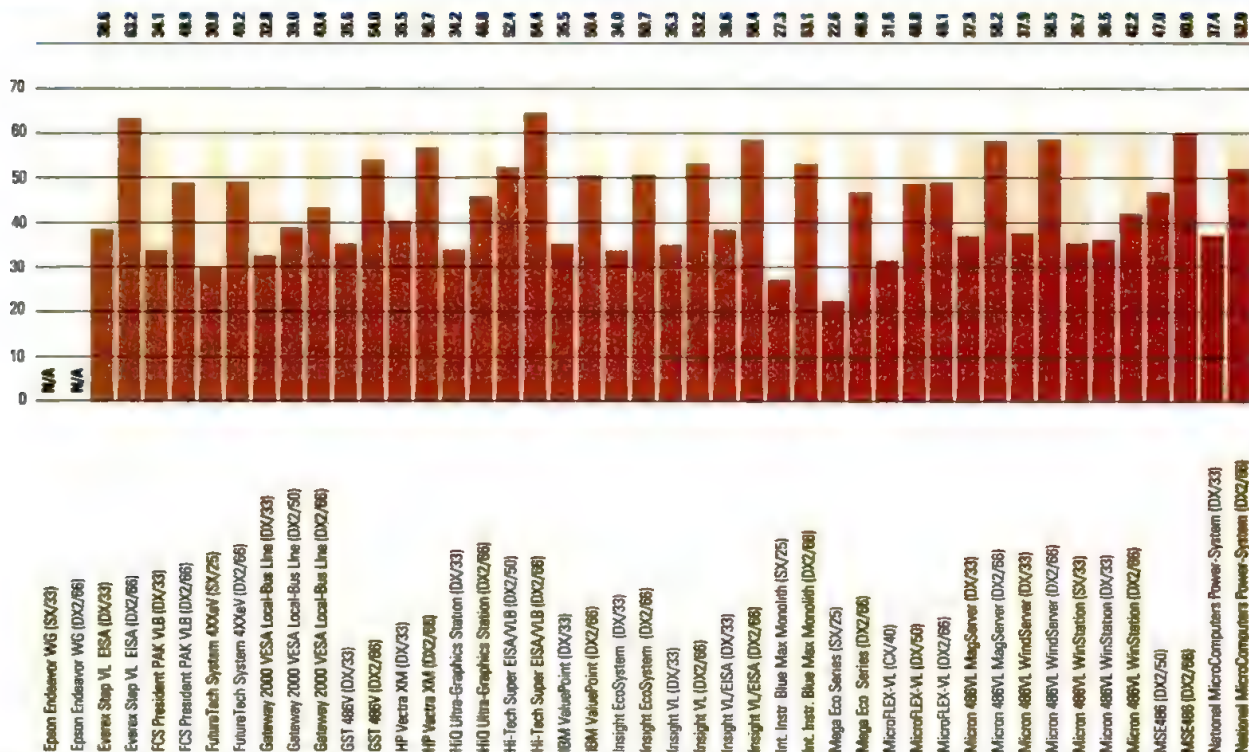


Benchmark Tests: The 486 Buyers' Guide

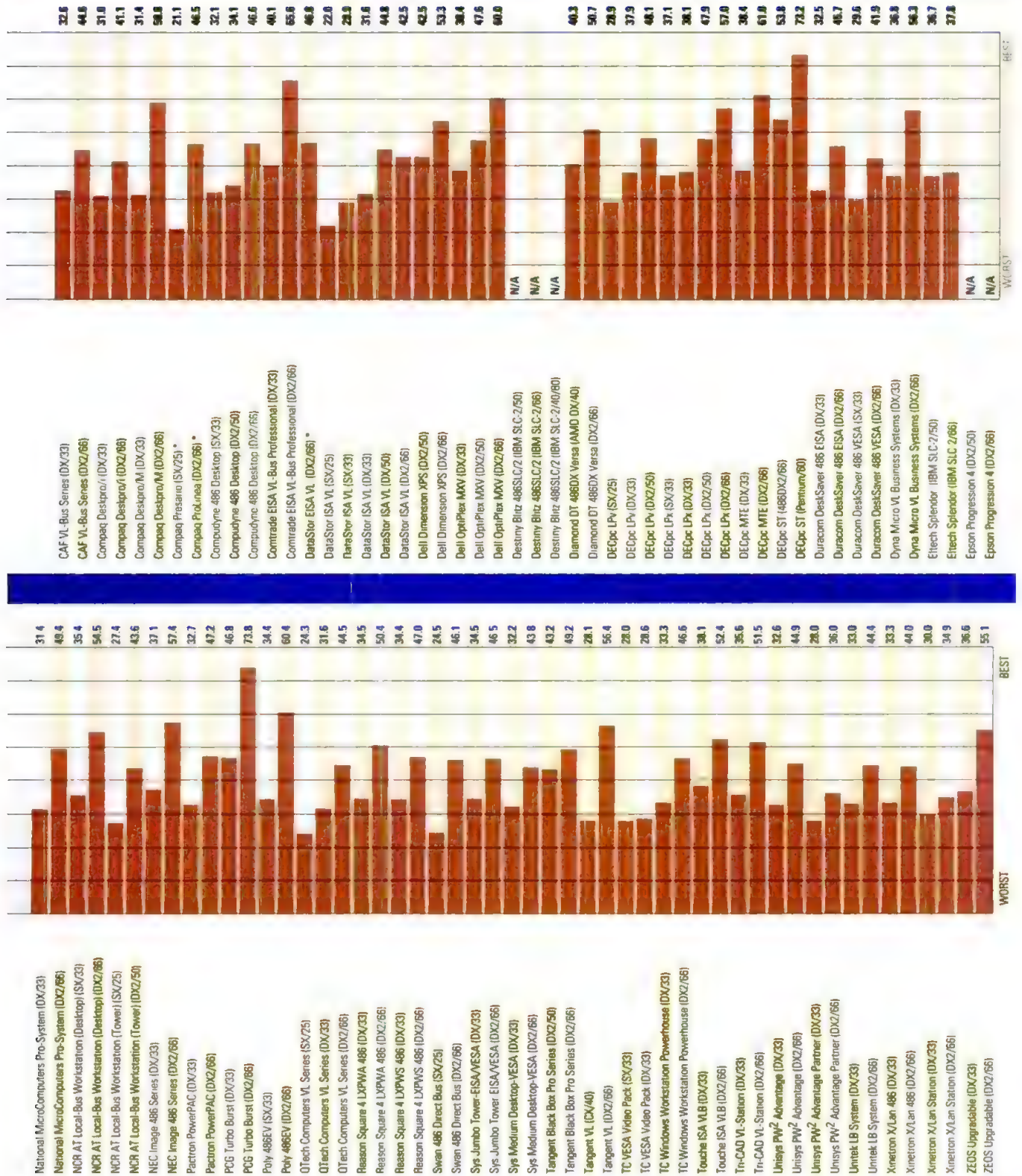
Winstone



Winstone (continued)



* This is the only system we reviewed from the manufacturer's line. N/A—Not applicable. At test time, the system's video driver was incompatible with our Winstone test.



■ Price/Performance Index: 486 Buyer's Guide

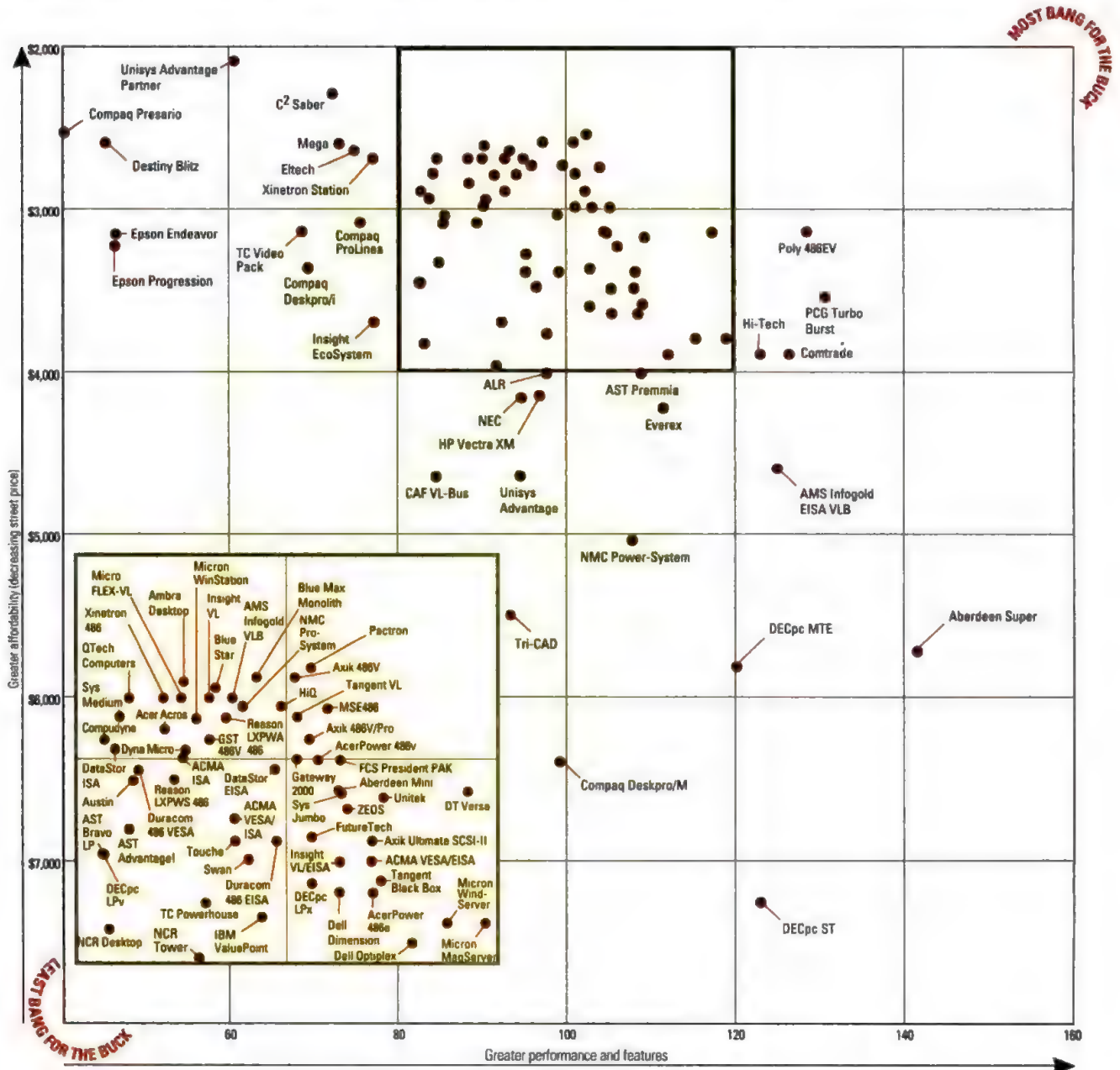
The bulk of tested PC families fall within the optimal upper-right-hand quadrant that denotes the maximum level of features and overall performance for a good price. Of the 89 tested lines, roughly two-thirds fell in that sector, showing that price and performance are not mutually exclusive concepts. The good news is that most lines offer VL-

Bus technology in fully equipped DX2/66 systems for less than \$3,500. For vendors, however, that means it took a bit more for their systems to pull away from the pack.

Units that balance price and performance especially well include the Poly 486EV, the Personal Computer Graphics Turbo Burst, and the Comtrade

EISA VL-Bus Professional, with DX2/66 units priced at \$3,150, \$3,547, and \$3,895, respectively. All come in roomy tower cases and have better-than-average warranties and top performance, especially in Microsoft Windows.

Many of the remaining systems, though not outstanding, offer a good mix of price and performance. They in-



clude 486 DX2/66 systems from Dell, Digital, Gateway 2000, Hewlett-Packard, IBM, and ZEOS. The Dell OptiPlex MXV, one of our Editors' Choices, offers a desktop case with only three bays, but balances that with a \$3,898 ISA/VL-Bus system with the roundup's best all-around performance.

Price-conscious buyers may want to examine the C² Saber 486 VL DX2/66 system: a decent system in a mini-tower case with VL-Bus technology for one of the lowest prices in this roundup (\$2,300). On the high end of the price scale is the DECpc ST Pentium EISA system. With top scores on our tests (with the exception of DOS video), it is definitely a performance leader, and its case and motherboard allow comfortable expansion, but it also comes with the highest price of this roundup, \$7,258. If your applications stress your CPU, the DECpc ST might be worth it.

All tested systems managed to steer clear of the worst lower-left-hand sector, reserved for those systems with an unenviable combination of high price and low performance. The Compaq Deskpro/M and Tri-Star Tri-CAD VL Station strayed nearest.

THE DATA POINTS

The Price/Performance Index reflects each machine's benchmark test scores, hard disk capacity, installed RAM, processor socket, flash BIOS, and expansion features such as local-bus, 16550 UART support, extended warranty, on-site service, and bundled software. Benchmark test scores are weighted to account for 65 percent of the performance index, while capacity and expansion features account for the remaining 35 percent. For more information see PC MagNet's Software Library Editorial Forum as 21BANG.XLS.

Scores were only calculated for the highest tested CPU within each line, and all pricing reflects our tested configuration.

See the Disk Spin.



See the Mouse Point.

See the CPU Process.

See How Computers Work.

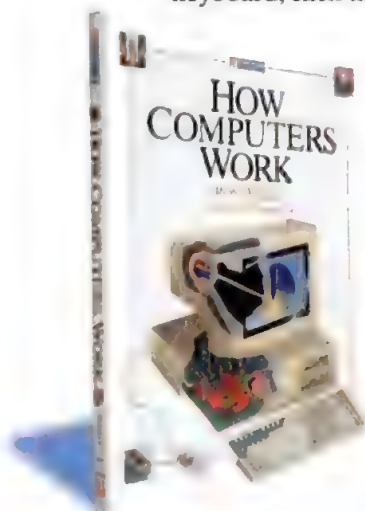
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Aberdeen Mini EISA VLB

Products in the moderately priced Aberdeen Mini EISA VLB line deliver average performance in mini-tower cases. For more expansion potential and high-end performance, look to the more expensive Aberdeen Super EISA VLB line.

Aberdeen Mini units come with processors ranging from a 486SX/25 to a 486DX2/66. Each unit's system board has five 16-bit ISA and three 32-bit EISA slots, two of which also serve as VESA local-bus slots. To conserve drive bays, the systems use combination 1.44MB and 1.2MB floppy disk drives. Each unit sports an easy-open case, with sides that swing out after two screws are loosened. Three fans help keep the inside cool.

► Aberdeen Mini EISA VLB

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT



of cache wasn't able to bump the models' disk scores past the average mark.

Aberdeen systems are covered by one-year parts and lifetime labor warranties. On-site service costs \$259 if a unit is over \$3,000 and \$199 if the list price is lower.—Bruce Brown

• **Aberdeen Inc.**, 7801 E. Telegraph Rd., Unit D, Montebello, CA 90640; 800-552-6868.

Circle 441 on reader service card

Aberdeen Inc.

Aberdeen Super EISA VLB

Each product in the Aberdeen Super EISA VLB line has the high-end edge of a combination EISA/VL-Bus. Priced on the high side, these units showed uneven

► Aberdeen Super EISA VLB

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	GOOD



performance, soaring in some respects and sinking in others. The sides of each model's tower case open to show four accessible 5.25-inch and three internal 3.5-inch drive bays. The motherboard has eight EISA slots (one doubles as a local-bus connection).

Models range from a 486SX/25 to a 486DX2/66. The high-performance features on each of the tested units, a 486DX/33 (\$5,495) and a DX2/66 (\$5,725), included 1MB of external RAM cache, a Diamond Viper VLB local-bus graphics card with 2MB of video RAM, a DataTech EISA caching drive controller with 4MB of disk cache memory, a 1.37GB Conner hard disk, and a 15-inch ADI MicroScan monitor.

These units posted consistently above-average scores—except for their DOS video and DOSmark numbers. These were hampered by the Viper graphics card, which excelled in Windows graphics but trailed in DOS video. The 33-MHz and 66-MHz systems managed third-place Winstone rankings in their respective CPU groups, however.

Aberdeen includes a one-year parts and lifetime labor warranty. On-site service contracts cost \$259 a year.—BB

• **Aberdeen Inc.**, 7801 E. Telegraph Rd., Unit D, Montebello, CA 90640; 800-552-6868.

Circle 441 on reader service card

Acer America Corp.

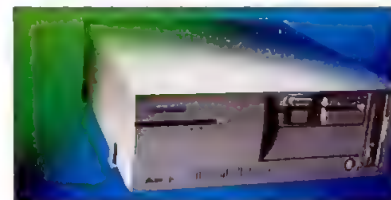
Acer Acros

Acer America Corp.'s small-fc low-end Acros systems offer easy at high levels of component integration low prices that come at the expense of top performance. They are, however, choices as entry-level PCs with local

Acer sells more powerful desktop computers in its AcerPower 486v AcerPower 486v lines. These may have more capacity and perform better than Acros systems with the same CPU. Acros prices range from \$2,299 for a 486SX/25 to \$2,849 for a 486DX2/66.

To get inside an Acros, you push on two integrated plastic latches to move the case front and then push on two more latches to remove the top. The case has three accessible bays and one internal 3.5-inch bay for four 16-bit ISA slots (two with VLB extensions) are all empty in the standard configuration since the Cirrus video circuitry and drive controller face are integrated into the motherboard.

The models' somewhat pedestrian components made them average performers on our tests. They posted below-average disk and Graphics WinMark scores and above-average DOS



scores. DOSmark and Winstone results were average for the DX2/66 but ranked first for the SX/25.

A one-year parts-and-labor warranty with on-site service is included with the Acer Acros system.—

• **Acer America Corp.**, 2641 Orch. Pkwy., San Jose, CA 95134; 800-72237.

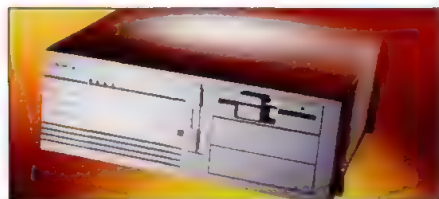
Circle 442 on reader service card

Acer America Corp.

AcerPower 486e

Though they are members of the highest-priced Acer desktop line, the AcerPower 486e models didn't perform as well as their less expensive ISA and VL-Bus 486v cousins on many tests.

With only moderate drive-expansion room and below-average performance, the 486e units, as equipped for testing, weren't competitive. Though they feature the same easy-access case as AcerPower 486v units, 486e models have dif-



► AcerPower 486e

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	GOOD

ferent motherboards, each of which has five 32-bit EISA slots, two 16-bit ISA slots, and one proprietary local-bus slot. Drive storage for the line is limited to four accessible

drives and two internal drives.

Prices for the tested 486e systems range from \$3,349 for a 486DX/33 to \$3,649 for a 486DX/66.

The 486e line uses a commonplace ISA-bus ATI VGA Wonder graphics card with 1MB of dynamic RAM, which was responsible for the models' very low scores on our DOS and Windows video tests. Their processor and disk scores were average. EISA systems are touted for their high data throughput potential, but the 520MB Fujitsu SCSI-2 hard disk paired with the EISA Adaptec drive controller with no cache did not bring scores past the average mark within the individual CPU classes.

On-site service is included with the one-year parts-and-labor warranty.—BB

• Acer America Corp., 2621 Orchard Pkwy., San Jose, CA 95134; 800-733-2237.

Circle 442 on reader service card

Acer America Corp.

AcerPower 486v

The AcerPower 486v family may be Acer's midpriced desktop line, but the systems' local buses made them the best Windows performers among the three Acer lines profiled here.

We tested a 486DX/33 (\$2,644), a 486DX2/50 (\$2,799), and a 486DX2/66 (\$2,999). Each came in an easy-to-open case with eight ISA slots (two with VESA extensions) and six drive bays (four for accessible drives and two for internal 3.5-inch drives only).

Each model came installed with a Diamond Viper VLB graphics board with 2MB of dynamic RAM. The board helped secure the DX2/66 model's top Graphics WinMark score, which ranked fourth overall. But the systems posted very low DOS video numbers. The installed 345MB Maxtor IDE hard disk had its own 64K of cache, but its lack of a caching drive controller contributed to the models' below-average DOS disk scores. Disk WinMark scores were average across all CPU test groups. A mother-

► AcerPower 486v

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT

board SCSI upgrade chip socket makes it easy to use SCSI rather than IDE drives.

As with the Acros and AcerPower 486e lines, there's no 16550 UART support, a drawback if you



want to engage in high-speed communication.

Acer offers a one-year parts-and-labor warranty. On-site service is included.—BB

• Acer America Corp., 2621 Orchard Pkwy., San Jose, CA 95134; 800-733-2237.

Circle 442 on reader service card

ACMA Computers Inc.

ACMA System ISA Series

The ACMA System ISA Series represents the entry point for products from ACMA Computers. These units are available in a choice of sturdy system cases, and their moderate expansion capabilities and middle-of-the-road performance make them decidedly solid midrange systems.

Current models range from a 486SX/33-based unit (\$2,595) to a 486DX2/66 system (\$2,990). Models in the ACMA VESA/EISA and the VESA/ISA series were faster during testing and have VESA local bus, but they also cost significantly more than ISA series models.

The 486DX/33 (\$2,695) and DX2/66 test machines came, respectively, in a small-footprint case with four drive bays and a mini-tower case with five bays. Each model contained one 8-bit ISA slot, seven 16-bit slots, one proprietary local-bus slot, and 256K of external cache.

Most test scores were average or below average, with the models' video scores trailing the pack under both DOS and Windows. The ISA-bus ATI Graphics Ultra video card with 1.5MB of RAM and the Promise drive controller with 2.5MB of cache only helped these units maintain average scores across their respective CPU groups.

All ACMA systems come with one-year warranties. On-site service is included.—BB

• ACMA Computers Inc., 47988 Fremont Blvd., Fremont, CA 94538; 800-786-6888.

Circle 443 on reader service card

► ACMA System ISA Series

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD



ACMA Computers Inc.

ACMA System VESA/EISA Series

Models in the ACMA System VESA/EISA Series are each based on an EISA-bus motherboard with a single VL-Bus slot. Though these are powerful PCs on paper, they ultimately don't measure up, delivering slower Windows performance than units in the ACMA VESA/ISA line.

Available with CPUs ranging from a 486SX/33 to a 486DX2/66, these units represent the highest-priced ACMA line. Prices range from \$3,100 (for an SX/33) to \$3,495 (for a DX2/66). The 486DX/50 (\$3,395) and DX2/66 units we saw came in sturdy tower cases, each with four accessible and four internal drive bays.

The models—each with a Diamond Stealth 24L graphics accelerator card—fared well in DOS video but poorly on our Graphics WinMark tests. The card uses the slow S3 P86C805 video accelerator chip; a switch to a local-bus video card with a faster accelerator chip is in order for Windows use.

Other scores were average compared with those of other systems sporting the same CPUs. Each model has an EISA-bus

DataTech SCSI caching disk controller board with 4MB of hardware cache. Though paired with a 545MB Conner SCSI hard disk with its own 256K buffer, this controller only helped secure the models' average overall results.

ACMA offers a one-year warranty with on-site service included.—BB

• **ACMA Computers Inc.**, 47988 Fremont Blvd., Fremont, CA 94538; 800-786-6888.

Circle 443 on reader service card

ACMA Computers Inc.

ACMA System VESA/ISA Series

The ACMA Computers line with the best tested performance is ironically the ACMA System VESA/ISA Series, which sits between the company's high-end VESA/EISA line and entry-level ISA line. Windows users looking for a sturdy conventional machine will do well with a unit in the ACMA VESA/ISA line.

Models range from a 486SX/33 (\$2,895) to a DX2/66 (\$3,290). We tested a DX/33 (\$2,995) that came in a small-footprint case with four drive bays and a DX/50 (\$3,180) that came in a full-tower case with eight bays. ACMA VESA/ISA-line motherboards each have seven 16-bit ISA slots, two with VL-Bus extensions.

During testing, ACMA VESA/ISA units were average performers across their respective CPU groups. One exception was their performance on our video tests. The models—each equipped with a local-bus Diamond Viper VLB board—managed very good Graphics WinMark scores but very poor DOS video marks. Data storage with all the tested units is achieved with a local-bus-based Impression IDE disk controller with 4MB of hardware cache and a 540MB Conner hard disk. This combination secured the models' above-average test results, which were higher under Windows than DOS.

A one-year warranty and on-site service are included.—BB

• **ACMA Computers Inc.**, 47988 Fremont Blvd., Fremont, CA 94538; 800-786-6888.

Circle 443 on reader service card

ACMA System VESA/ISA Series

SUITABILITY TO TASK

DOS applications **GOOD**

Windows applications **GOOD**

Expandability **GOOD**

Overall value **GOOD**



ACMA System VESA/EISA Series

SUITABILITY TO TASK

DOS applications **GOOD**

Windows applications **EXCELLENT**

Expandability **GOOD**

Overall value **GOOD**



Advanced Logic Research Inc.

ALR Evolution IV ISA

The nicely designed, solidly constructed ALR Evolution IV ISA line looks good and has plenty of expansion room. Unfortunately, this midrange family showed disappointing test performance.

Test units came in small-footprint cases, and CPUs ranged from a 486SX/33 to a 486DX2/66. Pricing seemed to be on the high side: \$3,425 for an SX/33, \$3,533 for a 486DX/33, \$3,648 for a 486DX2/50, and \$4,017 for a DX2/66.

Evolution IV units each have five drive bays, including two for internal drives only; five ISA slots; two VESA slots; and one proprietary local-bus slot. An ALR Tri-Combo I/O card installed in a VESA slot combines ATI Mach 32 chip-based, local-bus video circuitry with an Ethernet interface and 256K of external RAM cache.

This added up to below-average DOS video performance and very low Graphics WinMark scores across all CPUs. The integrated drive interface with no disk cache led to the models' somewhat below-average scores on all disk measures. The installed hard disk on each model was a 340MB Maxtor IDE model with a 32K cache buffer. Winstone

ALR Evolution IV ISA

SUITABILITY TO TASK

DOS applications **GOOD**

Windows applications **GOOD**

Expandability **GOOD**

Overall value **GOOD**



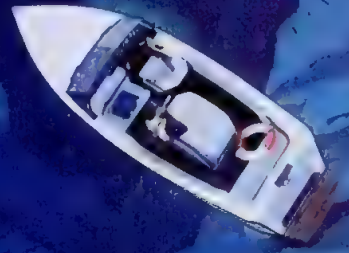
and DOSmark measures were slightly below average for all of the tested units.

ALR offers a five-year parts and 15-month labor warranty. On-site service is available for \$9.95 per year.—BB

• **Advanced Logic Research Inc.**, 9401 Jeronimo, Irvine, CA 92718; 800-444-4257.

Circle 444 on reader service card

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How the Chips Stack Up

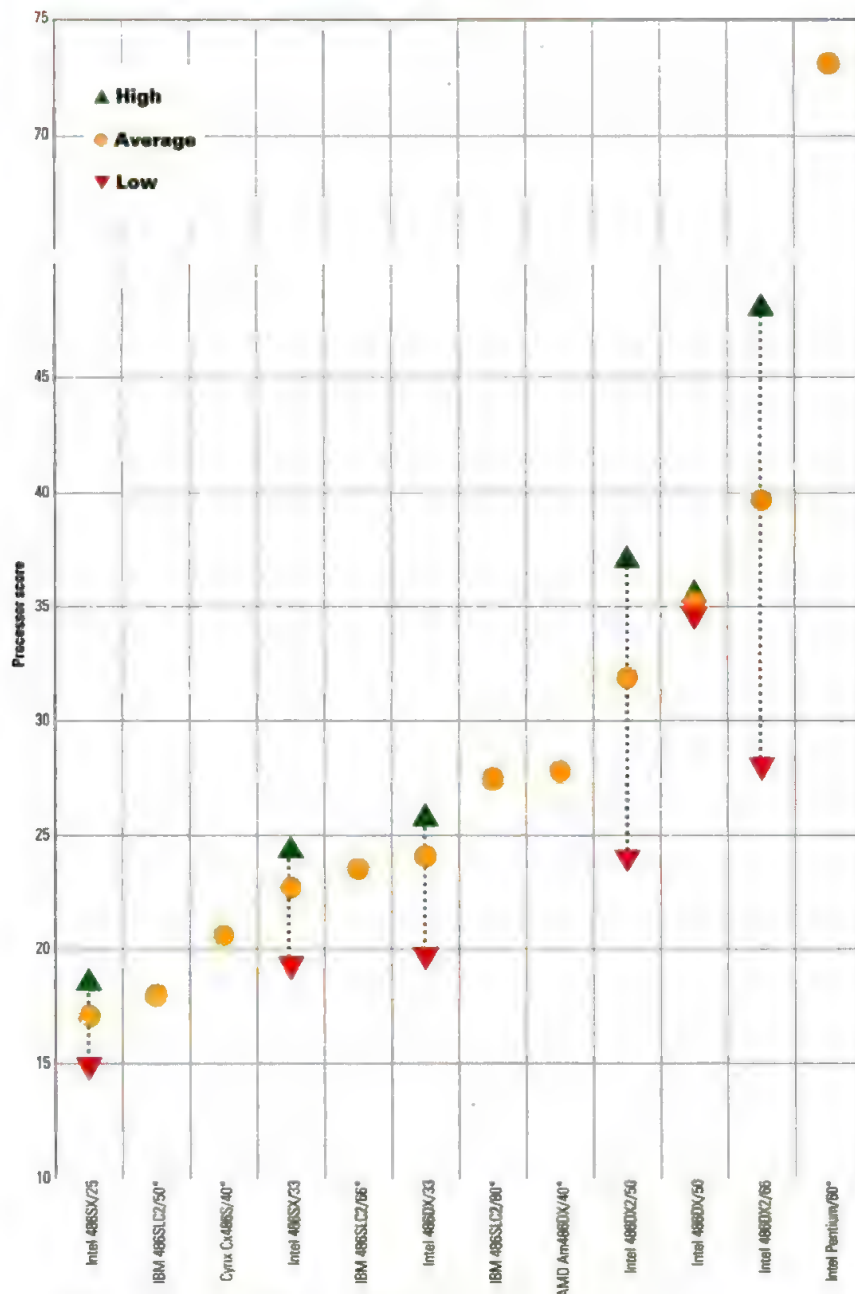
So you're looking for a 486-based PC. Which processor do you want inside? That may seem like a silly question, but buyers once selected a processor by picking a number such as 386 or 486. Now 486s dominate, yet prospective buyers' choice of processors is absolutely mind-numbing. Today Advanced Micro Devices (AMD), Cyrix Corp., IBM, and Intel sell more varieties of 486 chips than there were 286s, 386s, and 486s combined three years ago. (Texas Instruments shipped its first 486-class product after this story went to press.)

We tested PCs based on 12 different processors, from four vendors—all 486s except a lone Pentium. The 486 chips ranged from IBM 486SLC2s and Intel 486SXs at the low end to Intel 486DX2/66s at the high end. Based on their similarities and differences, it is not difficult to find the 486 that best suits your needs. Except for the IBM SLC2s, all these chips use the 486 instruction set, and are 32-bit processors with 32-bit data paths. The Big Blue clock-doubled SLC2s rely on a 16-bit data path and a 24-bit address path. The processor score differences can be attributed to four main areas: clock speed, clock doubling, internal data cache size, and presence of an integrated floating-point unit.

MORE MEGAHERTZ, MORE POWER

It's simple, hike up the system clock for a processor and you can expect it to work that much harder. The Intel 486SX/33s PCs we tested, for example, had an average score of 22.7 on the processor tests, almost a third higher than the 17.1 average score of the 486SX/25 units. These differences are explained by the 32 percent increase in clock speed between 33 MHz and 25 MHz.

With the higher speeds come higher prices—not only because of a faster, costlier processor, but also because of the required memory chips and other components. Many buyers today have settled on 33 MHz as a good balance



*We report only an average score for this processor, since it appears in only one or two of the tested systems

between performance and higher costs, although AMD and Cyrix offer 40-MHz 486s and Intel sells a 50-MHz 486DX.

CLOCK DOUBLING: NOT QUITE TWO TIMES

In order to wrest more performance out of the processor without jacking up the

cost of the system, processor vendors offer clock-doubled 486s. Intel's 486DX2/66 and IBM's 486SLC2/80 are two examples. Clock-doubling runs the 486 processing engine at twice the speed of the system clock so that for every system cycle, the processor has actually

completed two cycles. In practice, as our tests show, clock-doubling offers 60 to 70 percent improvement in processor power: The tested Intel 486DX/33 PCs scored an average of 24.1 on the processor test, while the 486DX2/66 PCs garnered a 39.7 average score.

CACHE IN ON SPEED

One method for improving clock-doubled performance is to cache data effectively so that the processor is never waiting for an instruction or information. The larger the cache, the more likely that information will be available when the processor needs it. Intel's 486s contain 8K of internal cache. IBM includes a 16K cache on its clock-doubled SLC2s, so theoretically its processor should be more efficient. The processor test scores don't, however, reflect the larger cache. That's because the IBM SLC2 lacks a floating-point unit and is not a full 32-bit CPU.

On the opposite side of the spectrum, the Cyrix Cx486S has no floating-point unit and only a 2K cache. The Cx486S in our roundup ran at 40 MHz, although its small cache played a role in a test score that falls slightly under that of a 33-MHz 486SX.

FLOATING-POINT OPERATION

Floating-point performance is another big factor that buyers need to consider. If you want to do 3-D modeling, CAD, or calculation-intensive spreadsheet tasks with your new 486-based PC, you should consider 486DXs or 486DX2s. You also have the option of buying a PC with no floating-point unit on its CPU, and installing a floating-point coprocessor later, if you find you need it.

If you're unsure of your needs reach for the highest CPU level you can. Current pricing has brought the power of a 486DX2/66 to within the reach of most buyers. Otherwise, make sure the system is upgradable so that if you tire of your 486SX/33, you can always move up the PC evolutionary ladder.—Mike Feibus

AST Research Inc.

AST Bravo LP

The AST Bravo LP line of small desktop PCs offers easy access and energy-saving "green PC" features. Based on the ISA bus and with minimal expansion capability, the Bravo PCs are best suited for undemanding single-user and workstation duty.

Bravo systems are available with 486SX/25 through 486DX2/66 CPUs. The tested 486DX/33 (\$3,082) and 486DX2/66 (\$3,461) models varied only in their RAM cache sizes, with 256K in the DX/33 and 64K in the DX2/66.

The two accessible and one internal



drive bays leave little room for expansion in systems equipped with 3.5- and 5.25-inch drives and a hard disk. Expansion is limited to two ISA slots.

Despite the use of integrated peripheral controllers, which can hinder performance, the Bravo units had average scores on all tests except for the Graphics WinMark test, where the ATI Mach 32 video chip helped produce below average scores. But the Bravo PCs did have slightly above-average DOS video scores, making them good for non-Windows users. With no disk controller cache, but an internal 128K drive buffer, the Western Digital Caviar 340MB hard disk kept scores respectable. The DOSmark and Winstone scores were just slightly above average.

AST offers a three-year parts-and-labor warranty with on-site service for the first year.—BB

• **AST Research Inc.**, 16215 Alton Pkwy., Irvine, CA 92718; 800-876-4278.
Circle 446 on reader service card

AST Research Inc.

AST Premmia

The AST Premmia series is the company's zenith in terms of price and performance. These small-footprint systems have only moderate expansion capability, but the Texas Instruments chip set and EISA bus enabled the Premmia PCs, especially the 486DX2/66 model, to score very well in our Windows tests.

Members of the Premmia line, from a 486SX/33 to a 486DX2/66 model, cost between \$3,366 and \$4,016. They perform far faster than the AST Bravo and Advantage! lines. The integrated ATI Mach 32 video circuitry with 2MB RAM contributed to exceptional Graphics WinMark scores and average DOS video scores compared with comparable CPU PCs. The Premmia's disk test scores were mixed, with better relative performance in the DX2/66 class than in the DX/33 (\$3,616) class. The Premmia uses the same Western Digital 340MB IDE hard disk with 128K buffer found in the reviewed Bravo systems.

All five 32-bit EISA slots are available in the Premmia line, thanks to the use of integrated video and drive controller circuitry. For a small-footprint case, the Premmia has reasonable drive capacity—three accessible 5.25-inch bays and two internal 3.5-inch



bays.

The AST Premmia's warranty covers parts and labor for three years and on-site service for one year.—BB

• **AST Research Inc.**, 16215 Alton Pkwy., Irvine, CA 92718; 800-876-4278.
Circle 446 on reader service card

Austin Computer Systems Inc.

Austin 486 Performance Systems

With only moderate drive-expansion room and slow performance the Austin 486 Performance Systems are middle-of-the-road competitors. The tested Austin



486 computers were a \$2,799 486DX/33 and a \$3,099 486DX2/66 version. They each have a nicely finished medium-size desktop case that contains three accessible 5.25-inch drive bays and two internal 3.5-inch drive bays. One of the internal bays, however, is located directly under the power supply, making it hard to use.

The VL-Bus motherboard has two 8-bit ISA slots, four 16-bit ISA slots, and two VL-Bus slots. An STB Powergraph VL-24 local-bus graphics board with an S3 Corp. 805 video accelerator chip and 1MB of dynamic RAM is installed in one

of the VL-Bus slots. This board enables the tested PCs to attain average DOS and Graphics WinMark test scores in each processor class.

The combination of a VL-Bus drive controller with no cache memory and a Western Digital Caviar 340MB IDE hard disk didn't produce competitive disk scores on either DOS or Windows disk tests. These significantly below-average scores held the Austin systems down in the DOSmark and Winstone measures.

A one-year, on-site service contract augments the Austin 486's two-year parts-and-labor warranty.—BB

• **Austin Computer Systems Inc.**, 10003 Metric Blvd., Austin, TX 78758; 800-752-1577.

Circle 447 on reader service card

Axik Computer Inc.

Axik Ace Cache 486V

The Axik Ace Cache 486V computers, a line of entry-level local-bus PCs, showed themselves to be particularly good DOS systems. While they sell for hundreds less than Axik's high-end systems, the Axik 486V units use the same large tower case as the more-powerful Axik Ace Cache 486V/Pro and Axik Ace Cache Ultimate SCSI-II lines.

In benchmark testing, we found the 486DX/33 (\$2,398) and 486DX2/66 (\$2,598) models to be well suited to DOS tasks. Based on a Diamond Stealth Pro 928 local-bus card, each PC achieved DOS video scores in the upper echelon of tested units. But Graphics WinMark scores were just slightly below average. A Maxtor 337MB IDE hard disk, with a 64K buffer connected to a Promise IDE VL-Bus drive controller, led to below average scores on both DOS and Windows disk tests. DOSmark and Winstone scores were about average for each system.

The Axik Ace Cache 486V tower case has ten drive bays—four accessible 5.25-inch bays, two internal 5.25-inch bays and four internal 3.5-inch bays. There are also five 16-bit ISA slots and two VL-Bus slots. Rather than loading these PCs with ten drives, it would probably be more appropriate to do so on a member of Axik's better-performing lines.

All Axik Computer systems include a one-year on-site warranty.—BB

• **Axik Computer Inc.**, 268 Santa Ana Ct., Sunnyvale, CA 94086; 800-234-2945. Circle 448 on reader service card



Axik Computer Inc.

Axik Ace Cache 486V/Pro

A step up from the Axik 486V line, the Axik Ace Cache 486V/Pro line is set apart by a 1MB cached hard disk controller and a fast graphics board. The result is better Windows performance, making a PC from the Axik 486V/Pro line a good choice as a fast Windows machine with lots of expansion potential.

Each Axik 486V/Pro model is housed in a ten-bay tower case that has seven ISA expansion slots, two of which do double duty as VL-Bus slots.

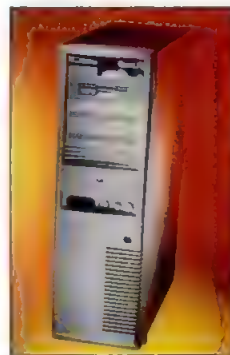
The processor scores of the tested \$2,698 486DX/33 system and its \$2,898 486DX2/66 sibling were slightly below average for their respective CPU groups. With a local-bus Promise IDE hard disk controller card these PCs manage above average DOS disk and Disk WinMark scores in the competitive DX/33 and DX2/66 system classes.

An Axik 486V/Pro PC uses a Diamond Viper VLB graphics card with 2MB video RAM, which turned in the expected high-flying Graphics WinMark scores. DOS video scores were problematic: Both the DX/33 and the DX2/66 turned in consistently below average

scores on most benchmark tests. The DOSmark score for each model was average, while each model's Winstone score was slightly above average.

The Axik Ace Cache 486V/Pro has a one-year warranty with on-site service.—BB

• **Axik Computer Inc.**, 268 Santa Ana Ct., Sunnyvale, CA 94086; 800-234-2945. Circle 448 on reader service card



Austin 486 Performance Systems

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Overall value	GOOD

Ace Cache 486V

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT

Ace Cache 486V/Pro

SUITABILITY TO TASK

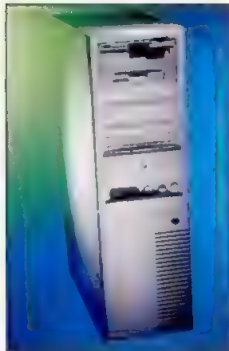
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT

Axik Computer Inc.

Axik Ace Cache Ultimate SCSI-II

If Windows performance is a priority, move up the Axik corporate product ladder to the local bus Ace Cache Ultimate SCSI-II line. These PCs benefit from a SCSI-2 hard disk cache controller and a fast graphics video board.

You can buy an Axik Ultimate system with a 486SX/25 CPU for as little as \$2,948, but a \$3,398 486DX2/66-based PC



Ace Cache Ultimate SCSI-II

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	EXCELLENT

is a better match for the fast video and drive components. The price range is higher than that of the Axik 486V and Axik 486V/Pro lines, but the increase is justified. The processor scores for the 486DX/33 version (\$3,198) and the 486DX2/66 version (\$3,398) systems were just above average for their respective CPU classes. Data storage is where the Axik Ultimate PCs excelled. Each has an UltraStor 34F VL-Bus SCSI-2 hard disk controller with a 1MB hard disk cache and a Quantum 525MB SCSI hard disk with its own 512K cache. These combined for system scores about 20 percent above average on DOS disk tests and Disk WinMark tests.

As usual the Diamond Stealth Viper VLB 2MB graphics card produced high Graphics WinMark scores at the expense of DOS performance. These systems had above average DOSmark and Winstone scores, indicating good performance.

The Axik Ace Cache Ultimate SCSI-II has a one-year warranty with one year of on-site service included.—BB

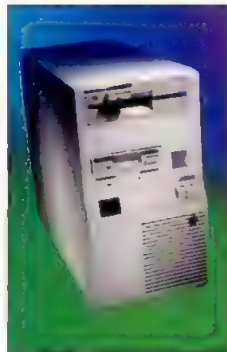
• **Axik Computer Co.**, 268 Santa Ana Ct., Sunnyvale, CA 94086; 800-234-2945.

Circle 448 on reader service card

Blue Star Marketing Inc.

Blue Star 486 VLB Pro Series

The Blue Star 486 VLB Pro Series has had trouble standing out from the crowd. A good line for DOS applications, these



PCs are less capable with Windows programs, largely because of their slow video boards.

The VLB Pro mini-tower case has five drive bays and houses an ISA motherboard with two 8-bit slots, three 16-bit slots, and two VL-Bus slots. Both local-bus slots were filled in each test system, one with a video card and the other with a combination local-bus hard disk controller and I/O card.

Both available VLB Pro models were tested—a 486DX/33 (\$2,399) and a 486DX2/66 (\$2,649) version. Except on video tests, each had average benchmark test scores. The Diamond Stealth 24VL graphics accelerator card, based on an S3 P86C805 chip, helped both systems achieve DOS video scores well above average; they lagged behind, however, on the Graphics WinMark tests.

The Seagate 340MB IDE hard disk with 256K of disk cache led to average scores on both DOS and Windows disk tests for the DX/33 test system. With the same hard disk, the DX2/66 model had above-average disk scores in both modes. Winstone test results were average for both systems.

Blue Star's five-year parts-and-labor warranty is outstanding, although on-site service for one year is a \$49 option.—BB

• **Blue Star Marketing Inc.**, 2312 Central Ave., Minneapolis, MN 55418; 800-950-8884.

Circle 449 on reader service card

C² Micro Systems Inc.

C² Saber 486 VL

In its pursuit of low prices for the C² Saber 486 VL line of computers, C² Micro Systems cuts corners and as a result sacrifices performance.

Price is the most attractive feature of the C² Saber systems. Each of these PCs is built around an ISA-bus motherboard that includes two VL-Bus slots and 256K of nonupgradable external RAM cache. You can buy the C² Saber as a 486SX/25 model for \$1,885 or a 486DX2/66 model for \$2,300 (tested configurations). But the subpar test results speak for themselves. For the C² Saber units tested,

C² Saber 486 VL

SUITABILITY TO TASK

DOS applications	FAIR
Windows applications	FAIR
Expandability	FAIR
Overall value	GOOD

all benchmark test scores were below average. Processor test scores were significantly below average, and consequently the other components—including the 345MB Max-

tor IDE hard disk and Kouwell ISA hard disk interface card—had trouble keeping up. DOS disk and Disk WinMark scores for the 486SX/25 system ranked among the bottom five of all reviewed units.

The only performance stand-out for these computers was in the DOS video category; scores here were significantly above average for the tested SX/25 and DX2/66 models thanks to the Cardex W32 local-bus graphics board, which is based on the Tseng ET4000/W32 chip set.

C² Micro Systems provides a one-year warranty for its C² Saber 486 VL line PCs. On-site service is available for an additional \$50.—BB

• **C² Micro Systems Inc.**, 47560 Seabridge Dr., Fremont, CA 94538; 510-683-8800.

Circle 450 on reader service card



TRAPPED IN THE BODY OF THIS TINY SER

This is a story about a small computer engineered to be so dependable, you won't think twice about trusting it with your mission-critical applications. And to be this without filling a closet,



much less a room. If you haven't thought of Compaq as an enterprise-critical platform before, we invite you to grab your bifocals and begin. (We'll be cramming a lot of information into this ad, which, given how much we managed to fit into our new servers, only makes sense.)

If there's one thing we've learned working with our customers, it's that you're running more and more mission-critical applications on your network. And if your network goes down, your business goes down. All of which makes the introduction of the new Compaq ProLiant Server even more timely.

The ProLiant is a new family of affordable, high-performance, easy-to-manage servers engineered specifically to provide the high availability you need for mission-critical networks. We've designed ProLiant in three different models, ranging from a single-processor configuration to a four-Pentium processor model.

Now, how can you be sure our server is truly a miracle and not a mirage? To begin with, there's Full Spectrum Fault Management, provided by Compaq Insight Manager technology and software that continually monitors over 800 aspects of the server's operating status. (For example, Drive Parameter Tracking checks 15 hard-drive parameters.) All of this information is constantly gathered, analyzed and then used to prevent, tolerate or recover from system problems.



If the performance of a monitored component drops below a specified level, our unique Pre-Failure Warranty kicks in. We'll actually replace a Compaq warranted drive or memory system free. Before it stops working. No downtime. Ringing cash registers. Happy boss.*



Still, no network's perfect. In the unlikely event problems occur, our server exhibits remarkable tolerance. Every ProLiant includes Compaq-designed hot-pluggable drives. ProLiant Models 2000 and 4000 come standard with advanced error-correcting memory and off-line backup processor features (whereby the server reboots

automatically to a second processor). And, most notably, the Compaq Smart SCSI Array Controller together with the ProLiant Storage System ensures mission-critical data integrity. Should a network problem bring the server down, the Rapid Recovery Systems of the ProLiant are designed to bring it back up.

VER IS A MAINFRAME WITH AN ATTITUDE.



For example, Automatic Server Recovery 2 uses a historical record of server status and performance to perform an astonishing array of tasks. Like intelligently restarting the server, automatically correcting a variety of problems, and accessing a telephone pager to contact network administrators.

By now you'd expect us to have rethought server setup, configuration and OS installation, but you might be surprised by the results. Introducing SmartStart, a CD-ROM system that takes the headache out of getting your server up and running. ProLiant includes a CD-ROM drive and bundled CDs of optimized

Netware and other major operating systems. To get hooked up to your network operating system, simply call your dealer for an access code, enter it, answer a few questions, and leave. Minutes later—say, after you've enjoyed a cup of coffee and a jelly donut—you'll return to find an integrated OS fully installed and optimized for increased performance and improved management. And we'll keep you updated via CD when new operating system versions appear.



And finally, to accompany our new line of mission-critical servers, we're introducing mission-critical support. With ProLiant, we now offer extensive analysis, installation and service through our CompaqCare System Partners, a select group of highly trained systems experts backed by Compaq engineers. You can now choose 4-hour on-site warranty response upgrade** direct from Compaq. Again, there's our unique Pre-Failure Warranty. And, of course, all Compaq servers come with a 3-year on-site[†] warranty, and .7-day-a-week, 24-hour-a-day technical support.



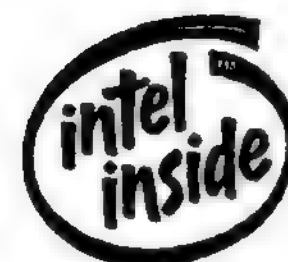
All in a surprisingly small box for not a whole lot of money. In fact, a DX2/66 Compaq ProLiant 1000 starts at about \$6000[†].

Which may help to explain the look your boss gives you when he hears how much money you've saved: stunned admiration. But you'll get used to that. It goes with the territory. For more information on the new



Compaq ProLiant servers, or for the location of an authorized Compaq reseller near you, just call us at 1-800-345-1518. If you'd like to receive model, feature and specification information immediately via fax, select the PaqFax option. Or, if you'd like that information even sooner, just turn the page.

COMPAQ



THE NEW COMPAQ PROLIANT MISSION-CRITICAL SERVERS

ProLiant 1000

ProLiant 2000

ProLiant 4000

HIGH PERFORMANCE NETWORK SERVERS			
Processor	Intel 486DX2/66 or Pentium 60MHz	Intel 486DX/50 or Pentium 66MHz	Intel 486DX/50 or Pentium 66MHz
Architecture	TriFlex/PC One Processor	TriFlex with up to two symmetric processors	TriFlex with up to four symmetric processors
Network Interface	Up to 12 High-Speed Channels; NetFlex 2 with Packet Blaster Technology Standard		
Standard Disk Controller	Integrated Fast SCSI-2 and Smart SCSI Array Controller (selected models)		
Storage Capacity	550MB-112GB Internal/external	1050MB-140GB Internal/external	1050MB-140GB Internal/external
Typical Usage	Departmental network services—primarily NetWare	Departmental network application services—NetWare, NT and Unix	Application services for preemptive downsizing—NT and Unix
Transaction Rating	50-150 TPS	200-300 TPS	300-400 TPS
Estimated Starting Street Price†	\$6,000	\$8,900	\$13,900
SERVER DEPENDABILITY AND AVAILABILITY			
Management	Second-generation Compaq Insight Manager (standard) combines with innovative hardware design to constantly monitor, assess and report server health and performance		
Fault Prevention	Insight Manager alerts you to server status changes in over 800 component parameters, allowing proactive server management backed by 3-Year Pre-Failure Warranty		
Fault Tolerance	Standard support for RAID levels 1,4,5; hot-pluggable drives; on-line spare drive; off-line backup processor‡; advanced ECC RAM§		
Fault Recovery	Standard rapid recovery services automatically return server to full operational status even in the event of a critical subsystem failure		
SIMPLICITY, EASE OF OWNERSHIP AND SUPPORT			
SmartStart	Standard CD-based intelligent hardware configuration and system software installation, providing simplified server configuration for NetWare, NT or Unix. (CD-ROM drive standard)		
System Warranty	Free Three-Year, On-Site Limited Warranty		
Pre-Failure Warranty	Three-Year, On-Site Warranty replacement of designated components that fall below preestablished thresholds		
4-Hour Warranty Response Upgrade	Optional Three-Year On-Site Warranty upgrade to 4-hour response		
Technical Support	Toll-free, 7 x 24 technical phone support from Compaq engineers		
CompaqCare System Partners	Highly trained, dedicated, third-party professionals who provide systems maintenance and comprehensive technical support		
QuickFind/PaqFax	Proactive notification and delivery of new technical information/7 x 24 fax response for updated specification, configuration and settings data		

COMPAQ

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CIRCLE 137 ON READER SERVICE CARD

CAF Technology Inc.

CAF VL-Bus Series

CAF Technology's CAF VL-Bus Series uses its two VESA local-bus slots to enhance video and hard disk performance. But high cost and spotty performance make these systems hard to recommend for demanding users.

The choices in this series include a \$3,797 486DX/33 model and a \$4,653 DX2/66 version. In addition to the VESA slots, the VL-Bus Series motherboard has seven 16-bit ISA slots. Customers can choose among mini-tower, tower, and desktop cases. Surprisingly, the full-size tower case housing the DX2/66 we tested has less drive capacity (three external and two internal 5.25-inch bays) than the DX/33's small-footprint case, which has bays for five accessible and two internal drives.

The bigger one has two fans, but its interior is marred by rough finish details and a number of sharp edges.

A local-bus Cirrus Logic graphics board with a Cirrus Logic video chip did well on DOS video but poorly on Graphics WinMark tests. Disk performance, with a Maxtor 345MB IDE hard disk and Promise IDE VLB caching drive controller with a 4MB disk cache, was about average in DOS mode and below average in Windows.

CAF Technology offers a one-year warranty but no on-site service contract.—BB

• **CAF Technology Inc., 1315 Johnson Dr., City of Industry, CA 91745; 818-369-3690.**

Circle 451 on reader service card



CAF VL-Bus Series

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Overall value	FAIR

Compaq Computer Corp.

Compaq Deskpro/i

A step up from the Compaq Presario and ProLinea series, the slimline Compaq Deskpro/i family is a relatively low-performance line that pales next to the high-end Compaq Deskpro/M, and at much of the competition.

The Compaq Deskpro/i is represented



in this roundup by a 486DX/33 unit (\$2,956) and a DX2/66 system (\$3,376). Its design accommodates up to 64K of external processor cache which is not user-upgradable, and the units that we tested had no cache, suggesting PCs that are more suited to lower-power CPUs. On the positive side, the Deskpro/i comes equipped with standard Business Audio circuitry, ports, and a microphone.

The slimline case's one external 5.25-inch and one 3.5-inch drive bay limit future flexibility. One of the three 16-bit expansion slots is taken by Compaq's QVision video card, which turned in below-average scores on our DOS video and Graphics WinMark tests. A Conner 340MB IDE hard disk with a 256K buffer connects to a drive interface that is integrated on the motherboard. Both DOS and Windows disk scores were below average. At well below average were the Deskpro/i's DOSmark and Winstone test scores.

Compaq Computer Corp. offers a three-year warranty with one-year on-site service.—BB

• **Compaq Computer Corp., P.O. Box 692000, M120208, Houston, TX 77269-2000; 800-378-8820.**

Circle 452 on reader service card

Deskpro/i	
SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	GOOD
Overall value	FAIR

Compaq Computer Corp.

Compaq Deskpro/M

The Compaq Deskpro/M line is the performance user's desktop unit. The small-footprint Deskpro/M has very high Windows performance, but that performance comes at a high cost.

You can buy a Deskpro/M with any CPU ranging from a 486SX/25 (\$3,520) to a Pentium 66 (\$6,399). The Deskpro/M also includes Compaq Business Audio, consisting of audio circuitry, ports, and a microphone.

In addition to one internal drive bay and three external bays, the Deskpro/M comes with one proprietary 32-bit and five 32-bit EISA slots that give it the best expansion capacity of Compaq's desktop lines.

The 33-MHz Deskpro/M (\$3,722) lagged on our processor tests. The DX2/66 (\$4,158) model, with 256K RAM cache, was the review's fourth-fastest system on our processor tests.

In Windows testing, the Compaq QVision video card with 1MB of video RAM helped the 66-MHz unit do notably well, as did the Conner 340MB IDE hard disk with its 256K disk buffer. Corresponding DOS test scores were below average, however.



Both the DOSmark and Winstone test scores were both above average.

The products in Compaq's Deskpro/M line come standard with three-year warranties and on-site service during the first year.—BB

• **Compaq Computer Corp., P.O. Box 692000, M120208, Houston, TX 77269-2000; 800-378-1442.**

Circle 452 on reader service card

Deskpro/M	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	FAIR

Compaq Computer Corp.

Compaq Presario

Compaq Computer Corp.'s Compaq Presario line for PC beginners and the burgeoning home market inserts a 14-inch screen into the unit case, giving a monolithic look much like a Macintosh Classic. Though you may demand more, the Presario's hardware/software bundle is a good value.

Chiefly for low-end applications, as shown in low test scores, the Presario comes with a 486SX/25 processor only; it expands to a 486DX2/66 CPU via a ZIF socket, but no external RAM cache is offered.

► Compaq Presario

SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	POOR
Expandability	POOR
Overall value	FAIR



Our \$1,819 test unit had 16MB of RAM and a 200MB hard disk. The PC has two drive bays for a floppy disk drive and internal hard disk. The motherboard sits under the monitor and has two 16-bit ISA slots.

A standard 9,600/2,400 fax/data modem with voice mail functions is integrated on the system board. The line can not accommodate an internal CD-ROM drive, but you can add a multimedia upgrade kit with an external CD-ROM drive.

Energy Star-compliant, this line has hard disk and monitor shutdown software in the Compaq Welcome Center and Compaq Control Panel Windows applications, both especially easy for inexperienced users. The Presario's set-up time from opening the box can be as little as 10 minutes.

Compaq Computer Corp. offers users a three-year warranty and one-year on-site service.—BB
Compaq Computer Corp., P.O. Box 692000, M120208, Houston, TX 77269-2000; 800-378-8820.

Circle 452 on reader service card

Compaq Computer Corp.

Compaq ProLinea

Compaq ProLinea, Compaq Computer Corp.'s general-purpose desktop line, trades expansion room and speed for

► Compaq ProLinea

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	POOR
Overall value	GOOD



small size and low cost. First-time buyers or those wanting Compaq quality and service at the lowest price will be happy. Some experienced computer users seeking expansion space may be disappointed.

The tested ProLinea's low-profile case had one internal and two accessible drive bays, leaving no room for additional disks. The system's high-level integration saves room, leaving the three 16-bit ISA slots free so you can add a faster video card, a modem, and even an additional hard disk on a card.

The series ranges from a 486SX/25 (\$2,045) to a DX2/66 (\$3,094), but installing a high-end CPU won't offset performance limited by the absence of external RAM cache. This lack showed in the DX2/66 model we tested—with below-average scores except for DOS video, where it excelled, thanks to a Tseng ET4000/W32 chip on the motherboard.

A Conner 340MB IDE hard disk with a 256K disk buffer has an interface that earned average disk scores in both DOS and Windows. General performance, as shown by DOSmark and Winstone scores, was just below average for the processor group.

The three-year warranty includes on-site service for one year.—BB

Compaq Computer Corp., P.O. Box 692000, M120208, Houston, TX 77269-2000; 800-378-1442.

Circle 452 on reader service card

Compudyne Products

Compudyne 486 Desktop

Each system in the Compudyne 486 Desktop line comes in a case that makes checking or changing components a simple process, providing an appropriate system for those who like to swap parts over the life of the system. Unfortunately, the Compudyne 486s' low-performance test results suggest that you're likely to want to swap components.

The Compudyne 486 test units—a 486SX/33 (\$2,299), a DX2/50 (\$2,599), and a DX2/66 computer (\$2,899)—all had 128K of external cache. Processor scores were well off the mark, however. Compudyne Products expects to be supplying a different motherboard with this line than the current SCI-made board. In light of the motherboard's poor performance showing, we would welcome that change.

With a 2MB Diamond Viper VLB graphics board, the Compudyne 486 systems turned in very good Graphics Winmark numbers, though this was at the expense of a good DOS video showing. The pattern of below-par performances



is true of the remaining categories. The motherboard-integrated IDE drive interface and Maxtor 345MB IDE hard disk didn't add up to anything other than slightly below-average test results.

All Compudyne 486 desktop systems have a one-year warranty with on-site service included.—BB

• Compudyne Products, 15167 Business Ave., Dallas, TX 75244; 800-266-7872.
Circle 453 on reader service card

► Compudyne 486 Desktop

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	POOR
Overall value	GOOD

PC Magazine Reveals:



The Computer That
Gives You The Most
Bang For The Buck.

Others pale in comparison. There's no way to dispute it! The results are in, and the ZEOS Upgradable 486DX2-66 is "the overall performance winner."

PC buyers expect low prices, top-quality, impeccable performance and prompt support. Basically, they want the most bang for their buck. *PC Magazine* recognized this and compared value-line PCs with more traditional systems to see if they were "truly good values or stripped-down machines trying to pass for good buys." The results are overwhelmingly in ZEOS' favor.

In fact, *PC Magazine* said: "ZEOS doesn't sell a separate value line, but the flexibility of its main system may be the least confusing solution of all."

THE WINNING SYSTEM

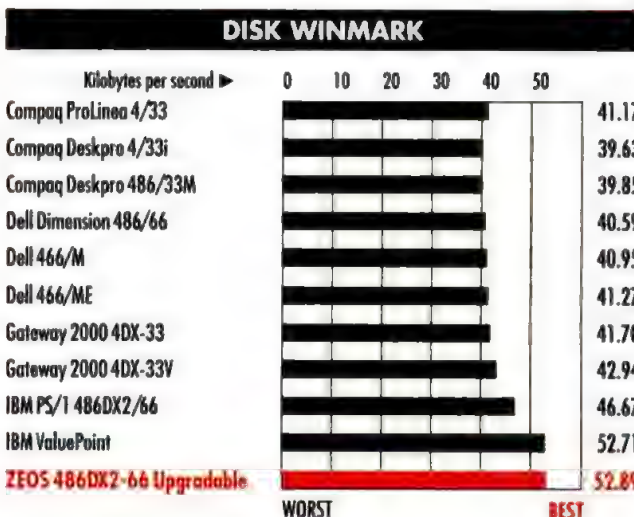
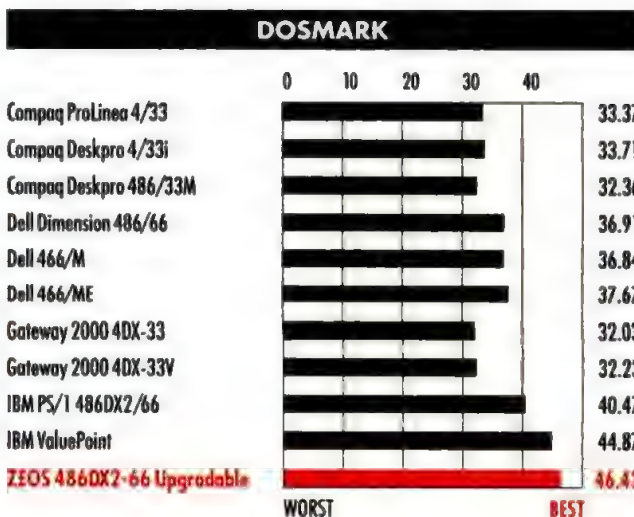
Stacked against Gateway, Dell, Compaq, IBM and others, ZEOS stood alone. Using the benchmark tests as a guide, *PC Magazine* made these conclusions:

"The clear winner is ZEOS' Diamond Viper VLB card in the ZEOS Upgradable, which turned in an incredible score of 55.01 megapixels per second."

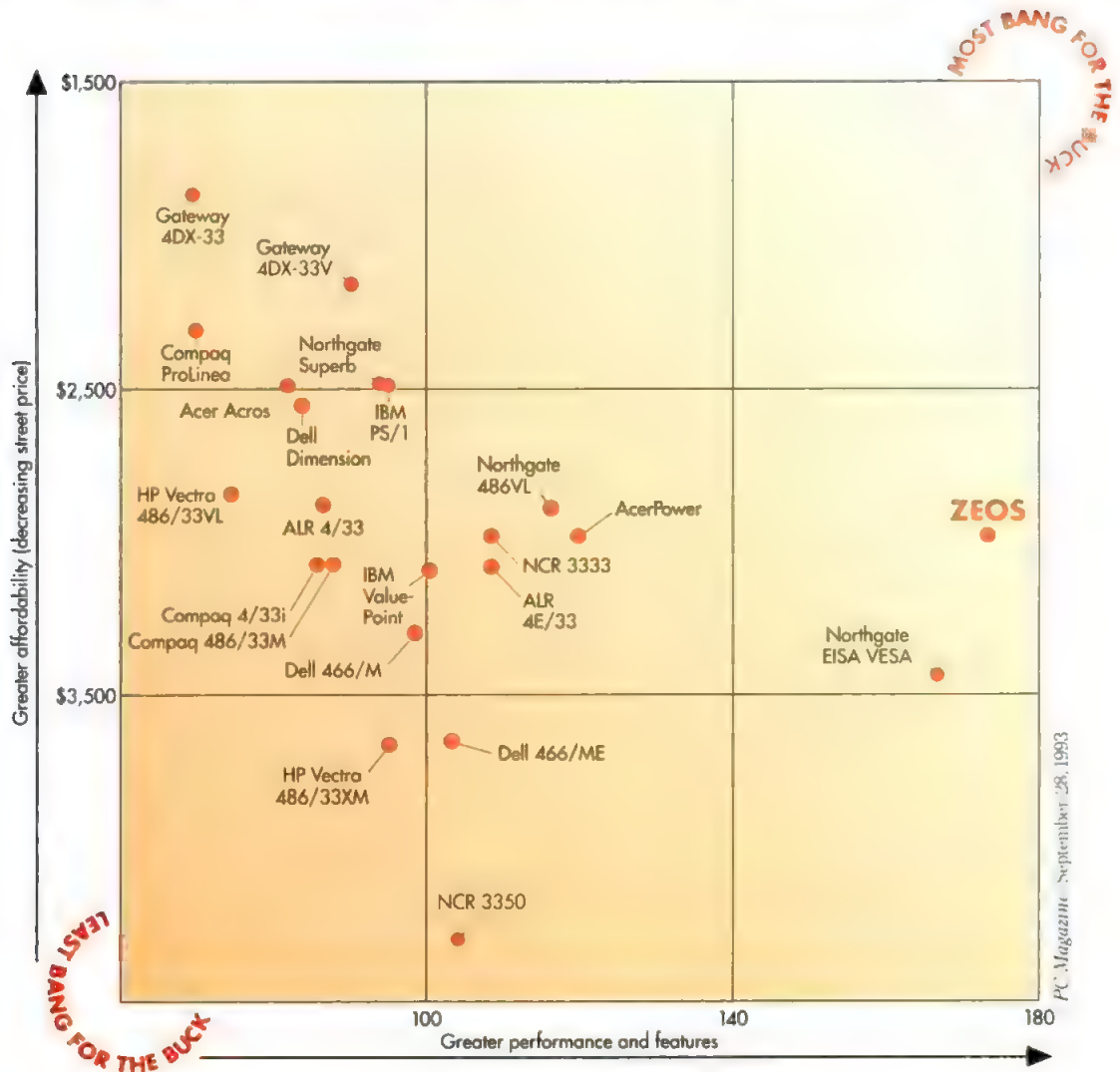
The Numbers Don't Lie.



The winning ZEOS system can easily be upgraded to a 10-bay vertical case for only \$95.



ZEOS® 486DX2-66...



The Top Gun.

THE WINNER: ZEOS 486DX2-66 UPGRADABLE... ONLY \$2995

- Genuine Intel 486DX2-66 Micro-processor; upgradable to Pentium™ OverDrive™
- 8MB RAM expandable to 64MB
- 256K SRAM system cache
- 528MB local bus IDE hard drive with 256K cache
- Diamond Viper/VLB local bus video card with 1MB VRAM
- 1.2MB and 1.44MB floppy drives
- 15" ZEOS color SVGA non-interlaced monitor, .28mm dot pitch
- 14,400 bps V.32 bis send/receive fax modem
- Microsoft DOS with Enhanced Tools, Windows, and new Microsoft Mouse, plus choice of Lotus Windows applications
- Same day shipping

This is just one ZEOS local bus upgradable configuration. Look on next page for additional money-saving packages or custom configurations.

AWARD-WINNING SERVICE, TOLL-FREE TECH SUPPORT, WARRANTIES & GUARANTEES



We're the only company to win *PC Magazine's* Readers' Choice for Service & Reliability—for both desktops and notebooks—*twice!*

We're here for you 24 hours a day, 365 days a year, and always a toll-free call away. All ZEOS systems come with a One Year Limited Warranty, Express Parts

Replacement Policy and a 30-Day Money-Back Guarantee.

WINDOWS APPLICATIONS OPTIONS

Packages 2, 3 and 4 come with your choice of either AmiPro, Freelance, Improv, Organizer, or the hot new Lotus 1-2-3 Release 4!



Choose Your Weapon.

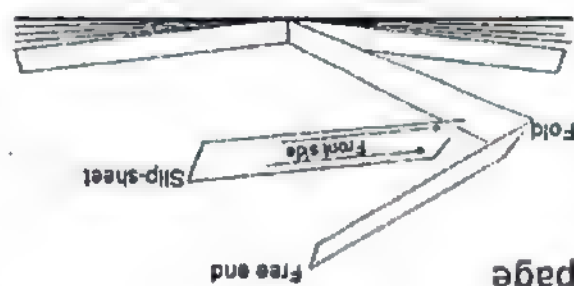
STANDARD WITH EVERY ZEOS UPGRADABLE SYSTEM	PACKAGE 1	PACKAGE 2	PACKAGE 3	PACKAGE 4
- Upgradable to Intel's Pentium® OverDrive™ CPU. Zero Insertion Force (ZIF) socket makes upgrading easy. - RAM expandable to 64MB on the motherboard. - Two serial ports and one parallel port integrated on the motherboard. - Flash BIOS for easy upgradability. - Eight expansion slots: two VESA local bus, five 16-bit and one 8-bit. - ZEOS six-bay desktop case with two cooling fans for increased reliability and product life. 200 watt power supply with built-in surge suppression; switchable between 115/230V. - Socket for inexpensive optional on-board SCSI. - Shadow RAM support. - ZEOS 101-key space-saving keyboard. - FCC Certified Class B; UL Listed. - Complete ZEOS Customer Satisfaction Package.	486SX-25 \$1395 Lease \$59/month 486SX-33 \$1495 Lease \$63/month 486DX-33 \$1595 Lease \$58/month 486DX2-50 \$1695 Lease \$61/month 486DX2-66 \$1895 Lease \$69/month - ZIF socket upgradability to Pentium OverDrive CPU 2MB high-speed RAM 107MB local bus IDE hard drive with 32K cache - Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. 16.7 million colors. - ZEOS 14" 1024 x 768 NI SVGA color monitor; .28mm dot pitch - Your choice of floppy drives - Microsoft DOS with Enhanced Tools	486SX-25 \$1695 Lease \$61/month 486SX-33 \$1795 Lease \$65/month 486DX-33 \$1895 Lease \$69/month 486DX2-50 \$1995 Lease \$72/month 486DX2-66 \$2195 Lease \$79/month - ZIF socket upgradability to Pentium OverDrive CPU 4MB high-speed RAM 214MB local bus IDE hard drive with 128K cache - Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. 16.7 million colors. - ZEOS 14" 1024 x 768 NI SVGA color monitor; .28mm dot pitch - Both 1.2MB and 1.44MB floppy drives - Microsoft DOS with Tools, Windows & new Microsoft Mouse, plus choice of Lotus Windows application	486SX-25 \$1995 Lease \$72/month 486SX-33 \$2095 Lease \$76/month 486DX-33 \$2195 Lease \$79/month 486DX2-50 \$2295 Lease \$83/month 486DX2-66 \$2495 Lease \$90/month - ZIF socket upgradability to Pentium OverDrive CPU 8MB high-speed RAM 426MB, 13ms local bus IDE hard drive with 128K cache - Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. 16.7 million colors. - ZEOS 14" 1024 x 768 NI SVGA color monitor; .28mm dot pitch - Both 1.2MB and 1.44MB floppy drives - Microsoft DOS with Tools, Windows & new Microsoft Mouse, plus choice of Lotus Windows application	486SX-25 \$2495 Lease \$90/month 486SX-33 \$2595 Lease \$94/month 486DX-33 \$2695 Lease \$98/month 486DX2-50 \$2795 Lease \$101/month 486DX2-66 \$2995 Lease \$108/month - ZIF socket upgradability to Pentium OverDrive CPU 16MB high-speed RAM 528MB, 12ms local bus IDE hard drive with 256K cache - Diamond SpeedStar Pro Windows-accelerated local bus video with 1MB RAM. 16.7 million colors. - ZEOS 14" 1024 x 768 NI SVGA color monitor; .28mm dot pitch - Both 1.2MB and 1.44MB floppy drives - Microsoft DOS with Tools, Windows & new Microsoft Mouse, plus choice of Lotus Windows application
FAVORITE OPTIONS 426MB to 528MB HDD UPGRADE\$125 256K SYSTEM CACHE\$98 ADAPTEC 6360 SCSI CONTROLLER CHIP For on-board SCSI. Includes drivers\$49	2400 bps V.42 bis MODEM WITH 9600 bps SEND/RECEIVE FAX\$99 DIAMOND VIPER VIDEO CARD 1MB VRAM: \$149 2MB VRAM: \$249 15-INCH MONITOR UPGRADE SVGA non-interlaced, 1024 x 768, flat screen\$95	COMPLETE MULTIMEDIA PACKAGE Double speed, multisession, MPC2 compliant CD-ROM. 16-bit/48KHz Cardinal Digital Sound Pro 16 with Digital Signal Processor (Soundblaster and Adlib compatible). Stereo speakers\$395 <i>Many other affordable upgrades and options available. Call for details!</i>		

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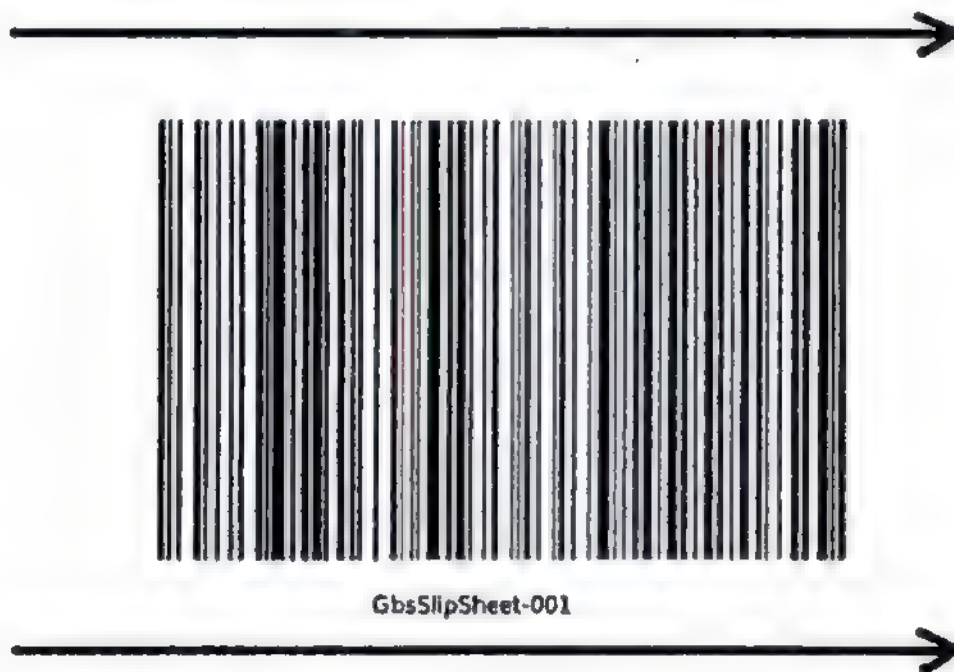


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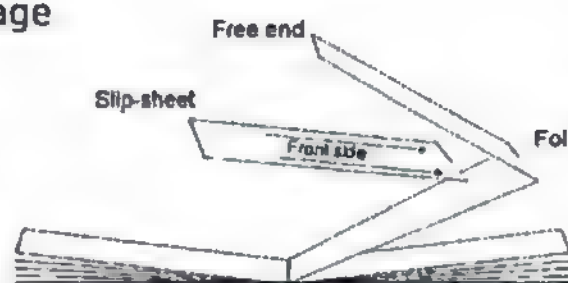
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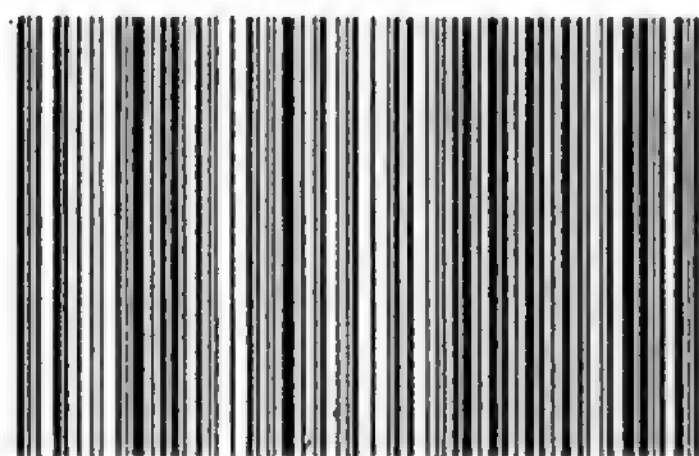
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"The ZEOS 486DX2-66 Upgradable's hard disk performance was almost 31 percent above the average in this roundup."

"As DOSmark scores are heavily weighted for processor and hard disk performance, the ZEOS garnered the first-place position in that category as well."

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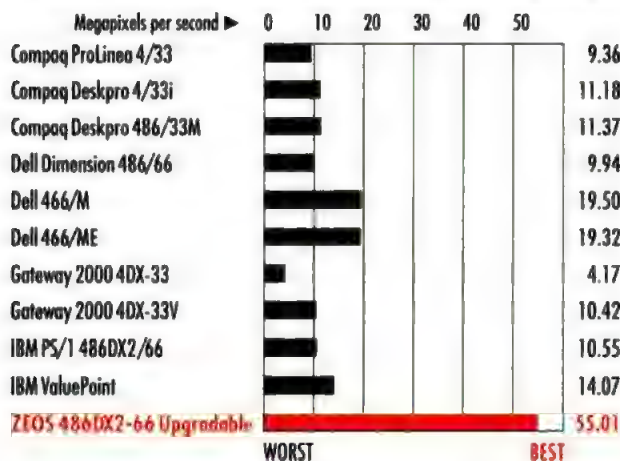


ahead to your future needs and technological advances; therefore, we include such features as CPU upgradability to Intel's Pentium OverDrive; a Zero

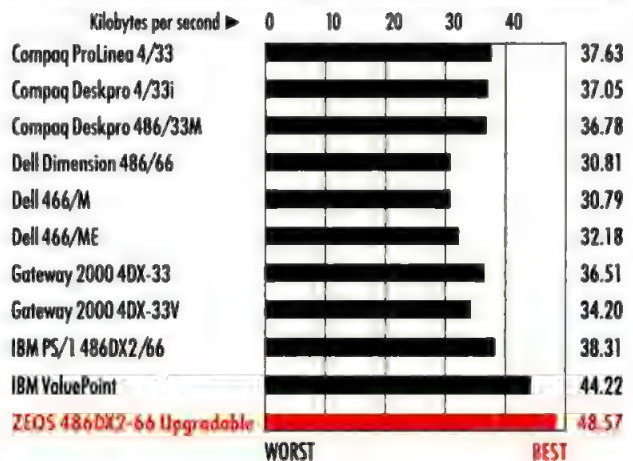
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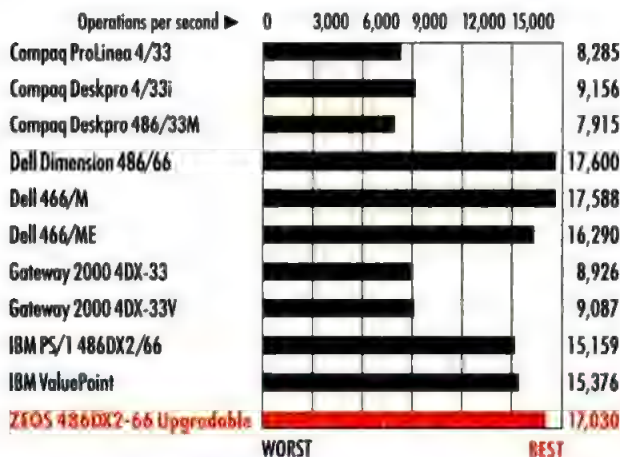
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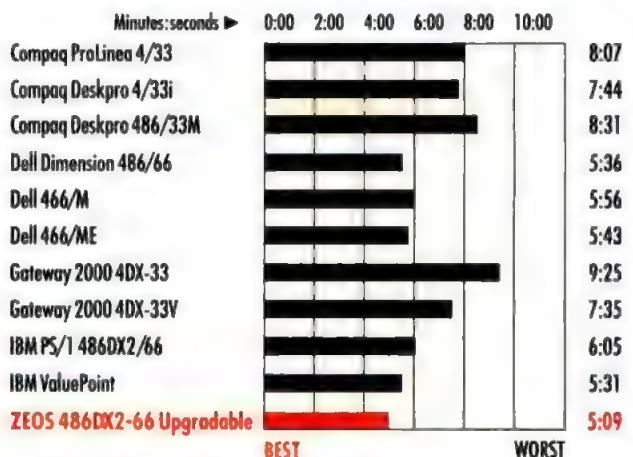
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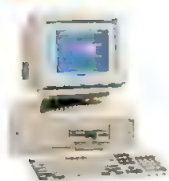
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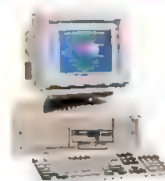
486
SX-25



486
DX-33



486
DX-33



486
DX2-66

PACKAGE #2:

- 4MB RAM
- 214MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

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PACKAGE #2:

- 4MB RAM
- 214MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$1895

PACKAGE #3:

- 8MB RAM
- 426MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2195

PACKAGE #3:

- 8MB RAM
- 426MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2495



486
DX2-66



486
DX2-66



486
DX2-66



Ambra™
486SX-25

PACKAGE #3 BONUS:

- 8MB RAM
- 256K SRAM system cache
- 528MB local bus IDE hard drive
- Diamond Viper local bus video card
- 15" SVGA color monitor
- Both floppies
- 14,400 bps V.32 bis send/receive fax/modem
- DOS, Windows, Mouse
- Choice of Windows application

\$2995

PACKAGE #4:

- 16MB RAM
- 528MB local bus hard drive with built-in 256K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2995

PACKAGE #4 PLUS:

- 16MB RAM
- 528MB local bus hard drive with built-in 256K cache
- Diamond Viper local bus video card
- Vertical case
- 15" SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$3334

PACKAGE #1:

- 4MB RAM
- 107MB hard drive with built-in 32K cache
- Both floppy drives
- SVGA color monitor
- DOS, Windows, Mouse

\$1395

*Orders must be for ZEOS Computers Now! configurations; we've listed just a sampling here. Since we continuously update this list of configurations, please call to confirm your system is on the list. This offer is good only as long as these pre-built systems remain in stock. Other ZEOS systems and custom configurations take slightly longer—about a week. Credit cards are subject to authorization. Orders must be received by 1 p.m. Central Time, M-F.

Circle 155 on reader service card.



Comtrade Comtrade EISA VL-Bus Professional

The Comtrade EISA VL-Bus Professional line costs a bit more than many competitors, but extra money buys exceptional performance—especially under Windows. The \$3,645 DX/33 and \$3,895 DX2/66 Comtrade PCs tested will be valued by users wanting good drive capacity and top performance.



Comtrade EISA VL-Bus Professional

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	EXCELLENT

the front of the accessible drives and the power, reset, and turbo switches.

The EISA bus system has eight 32-bit slots, two with VL-Bus extensions. One local-bus slot in the test units was taken by Diamond Stealth Viper VLB graphics adapters with 2MB of VRAM. The systems' low DOS video scores were offset by exceptional Windows-based test scores—including the DX2/66's fourth-place Winstone ranking. The systems' Data Tech EISA SCSI hard disk controller with 4MB of disk cache and a Conner 540MB SCSI drive earned very high DOS and Windows disk scores, ranking third and second. This is a high-end system that excels in Windows.

Comtrade's generous three-year parts-and-lifetime labor warranty includes one-year on-site service.—BB

• **Comtrade**, 15314 E. Valley Blvd., City of Industry, CA 91746; 800-969-2123.

Circle 454 on reader service card

Data Storage Marketing Inc.

DataStor EISA VL

The DataStor EISA VL line may seem identical to its sibling ISA line, but inside, there's a world of difference in its architecture and components. The combination VL-Bus/EISA PC line delivers good performance for its cost.

Available in different configurations, our \$3,045 test unit had a DX2/66 processor, a 345MB Maxtor SCSI hard disk, a VL-Bus video and hard disk controller, and a 14-inch monitor with built-in speakers and audio jacks. You can order DataStorage's EISA PC in a tower case, but the small-footprint desktop case offers easy memory access and five external drive bays. The DataStor EISA's documentation gives all information needed but certainly isn't aimed at a beginner.

Inside, both VL-Bus slots are filled (the STB Powergraph video adapter in one, an UltraStor 34F VL-Bus SCSI bus-mastering controller in the other) and you lose two extra EISA slots to awkward wiring of the I/O adapter card. The motherboard is upgradable with a ZIF processor socket and a removable oscillator crystal.

DataStor EISA VL

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	EXCELLENT



scream, but it offers solid performance, an attractive features set, and also the three-year warranty from Data Storage Marketing with one-year on-site service.—Oliver Rist

• **Data Storage Marketing Inc.**, 5718 Central Ave., Boulder, CO 80301; 800-543-6098.

Circle 455 on reader service card

Data Storage Marketing Inc.

DataStor ISA VL

Data Storage Marketing's DataStor ISA VL line holds no surprises. This conventional ISA bus design with two VESA local-bus slots is an average performer in an average case at average cost for those needing neither exceptional performance



DataStor ISA VL

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Overall value	GOOD

nor very large amounts of drive storage potential.

The DataStor ISA's desktop case has three accessible 5.25-inch and two accessible 3.5-inch drive bays. The five units we tested represented the gamut of available CPUs, from a \$2,395 486SX/25 model to a \$2,945 DX2/66, with midlevel systems proportionally priced. In addition to CPU, there is variation in motherboard-mounted external RAM cache: The 486SX/25 and SX/33 models have 128K caches while the DX/33 and faster units have 256K.

An STB PowerGraph VL-24 graphics adapter with an 805 video accelerator chip from S3 Corp. sits in one of the two VESA slots. This board helps the systems achieve good DOS video scores but below-average Graphics WinMark results. The second local-bus slot holds a Promise 2MB IDE caching disk controller. This controller with a Maxtor 340MB 64K buffer IDE hard disk provides average performance as tested, though slightly above that in DOS disk tests.

The DataStor lines have a three-year warranty. One-year on-site service is included for the first year.—BB

• **Data Storage Marketing Inc.**, 5718 Central Ave., Boulder, CO 80301; 800-543-6098.

Circle 455 on reader service card

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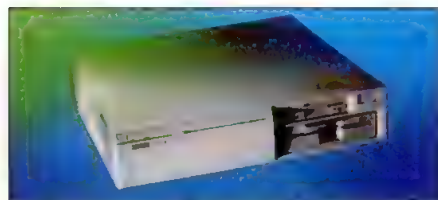
CIRCLE 379 ON READER SERVICE CARD

Digital Equipment Corp.

DECpc LPv

Like the other three lines from Digital Equipment Corp., the DECpc LPv made a good showing in performance and features. Aimed at business and home users with modest applications needs, it is housed in a cleanly designed small-footprint executive workstation.

Digital sent us three versions of the DECpc LPv, powered by SX/25 (\$2,715), DX/33 (\$3,137), and DX2/50 (\$3,302) processors. Though a few may feel limited by the pizza box-style case, it does have room for one extra external drive and three 16-bit ISA expansion slots—no



► DECpc LPv

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

serious constraint in view of the system's level of motherboard integration.

Performance for all LPvs was outstanding in DOS and Windows, making them good all-

round systems. Processor and DOSmark scores for the SX/25 and DX2/50 units were consistently in the top 5 of their CPU class; the DX/33 consistently made the top 15. The LPv uses a 524MB Quantum drive combined with a 512K cached disk controller to get scores 20 percent above average in both DOS and Windows disk tests. The DX2/50 and the SX/25 also hit the top five among CPUs in other Windows tests. The DX/33 fell to 33rd in Windows Graphics, partly owing to the S3-based video system.

Digital offers a three-year parts-and-labor warranty with one-year on-site service and toll-free technical support from 8:30 A.M. to 8:00 P.M.—OR

• Digital Equipment Corp., 40 Old Bolton Rd., Stow, MA 01775; 800-722-9332. Circle 456 on reader service card

Digital Equipment Corp.

DECpc LPx

Digital Equipment Corp.'s DECpc LPx computers are slightly more robust relatives of the DECpc LPv series. The two lines share some hardware traits, but the LPx units offer more room to expand, and the potential for better graphics performance by taking video off the motherboard and placing it on a VESA local bus.

Digital sent us four flavors of LPx, all based on Intel microprocessors: a 486SX/33 (\$2,963), a 486DX/33 (\$3,277), a 486DX2/50 (\$3,442), and a 486DX2/66 (\$3,603). These prices were higher than those of many competitors, but the list of high-quality components make the prices seem worthwhile. The LPx series uses the same 524MB Quantum hard disk—with 512K of hardware cache—that the LPv series does. Video is taken care of with an S3-based subsystem, but while the LPv line uses the P86C805 chip, the LPx line uses the P86C928 chip.

The result was superior performance across the board. All machines scored above average in their processor class on all tests. Many LPx systems rose solidly into the next group up the CPU ladder. This was also true for Winstone scores. And the DX2/66 configuration was ranked fourth for the entire roundup in its DOSmark score.

The attractive warranty provides three years parts-and-labor coverage and



one year of on-site service. Technical support is available toll-free during extended business hours.—OR

• Digital Equipment Corp., 40 Old Bolton Rd., Stow, MA 01775; 800-722-9332. Circle 456 on reader service card

Digital Equipment Corp.

DECpc MTE

Digital Equipment Corp. recommends its new DECpc MTE computers for use either as high-end PCs or as small file servers. Though the spacious interior allows for extensive customization, the MTE



units' benchmark test scores show them to be more appropriate for use as Windows workstations.

Each of the two tested units was housed in a mini-tower case and included an optional monitor

and high-resolution VL-Bus graphics adapter. We tested a 486DX/33 (\$5,415) and a 486DX2/66 (\$5,818) configuration.

Network buyers may be disappointed by the case's limitation to five drive bays. The EISA motherboard, however, has five empty EISA slots and another backed by a VL-Bus extension. This holds the Diamond Computer Viper VLB video adapter; all other I/O and drive circuits are on the motherboard.

Test results were mixed: Both PCs had low DOS video scores balanced by high Graphics WinMark scores—undoubtedly because of the Weitek Power 9000's penchant for GUI environs. Disk numbers were competitive for both CPU types; the DX2/66 screamed in Windows with the fifth highest Disk WinMark and seventh best Winstone score of the roundup.

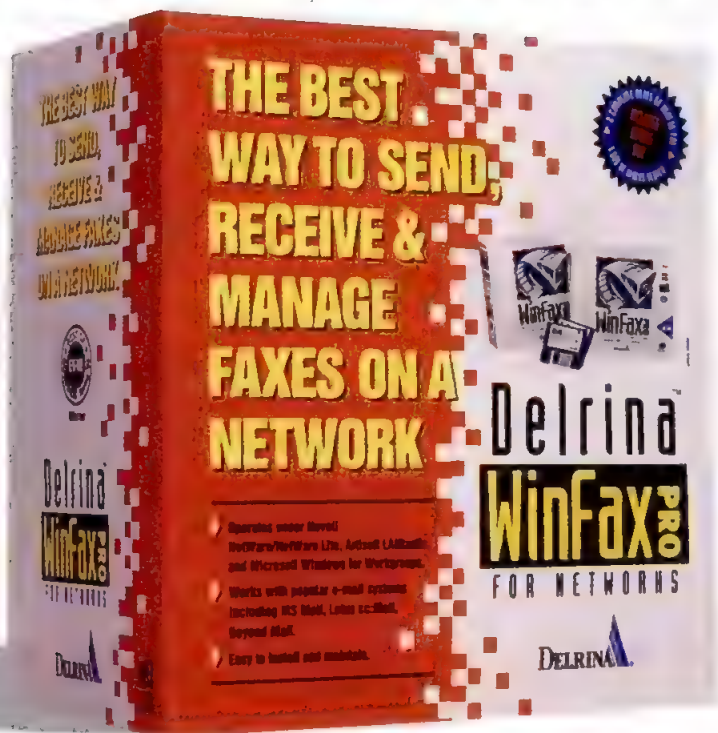
Digital ships the MTE line both direct and through resellers. A three-year parts-and-labor warranty comes standard (first year on-site included) and technical support is toll-free.—OR

• Digital Equipment Corp., 40 Old Bolton Rd., Stow, MA 01775; 800-722-9332. Circle 456 on reader service card

► DECpc MTE

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	GOOD
Overall value	FAIR

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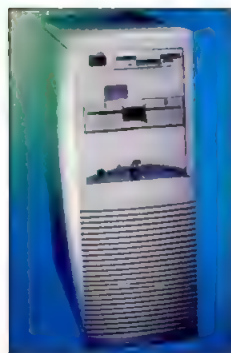
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CIRCLE 250 ON READER SERVICE CARD

Digital Equipment Corp.

DECpc ST

Digital Equipment Corp.'s full-tower DECpc ST line includes the only Pentium PC (\$7,258) in this roundup as well as a 486DX2/66 (\$5,393) model. Each can be configured as either a high-end workstation or a midrange file server. Performance was uneven, hitting a high in many benchmark tests, but falling dead last in DOS-based video.



▶ DECpc ST

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	FAIR

that also hold 256K of external cache, BIOS, and clock crystal, making for a one-step upgrade.

Performance scores for these systems were mixed. Predictably, the Pentium PC had the highest processor score of the roundup. The DX2/66 also performed well with fifth-ranking Disk WinMark scores. Each tested PC uses a 524MB Quantum hard disk with 512K of hardware cache and achieved above-average DOS disk scores. DOS video scores were substandard, indicating that the family may be more appropriate as file servers than as advanced workstations.

The ST PCs have a three-year parts-and-labor warranty and toll-free support during extended business hours.—OR

• **Digital Equipment Corp.**, 40 Old Bolton Rd., Stow, MA 01775; 800-722-9332. Circle 456 on reader service card

Dell Computer Corp.

Dell Dimension XPS

The Dell Dimension XPS line is targeted at home users or small businesses that can't afford the high cost usually associated with high performance. Dell Computer Corp. has squarely hit both marks.

Granted, your eyebrows may jump at first glance of the price—\$3,546 for a 486DX2/50 and \$3,646 for a 486DX2/66 PC. But consider the configuration: 16MB of RAM, 256K cache, 450MB hard disk, local-bus video, 15-inch monitor, CD-ROM drive, and a sound card. And Dell really put it all together to get excellent performance from both models.

Not only did each tested PC rank in the top five or ten on most tests within its CPU group, but in many cases it led the roundup. This was particularly true for the DX2/66, which hit the top ten on DOS video, DOS disk, DOSmark, and Disk WinMark tests.

If you're new to PCs, you'll appreciate Dell's especially good job of packaging the computer for beginners. As with most Dell machines, these units arrive with a

▶ Dell Dimension XPS

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	GOOD
Overall value	GOOD



number of clearly written and illustrated manuals. This documentation covers just about every aspect of your computer system.

If your questions aren't answered in the manuals, call the

24-hour technical support line. You also get a one-year parts-and-labor warranty with free on-site service.
Any way you slice it, the Dell Dimension XPS is a great deal.—OR
• **Dell Computer Corp.**, 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355. Circle 457 on reader service card



Dell Computer Corp.

Dell OptiPlex MXV

Dell hopes to attract advanced business users with the new Dell OptiPlex MXV PCs. Attractive pricing (from \$3,498 for a 486DX/33 to \$3,898 for a 486DX2/66 as tested) and unmatched performance make the line's future bright.

The small-footprint case is nicely



styled and holds five drive bays. This should not be a problem for most users because of Dell's choice of a dual-media floppy disk drive that saves a bay. The case has five ISA slots and a pair of VL-Bus connections—one of which is occupied by the local-bus video card.

The rest of each system carries the usual Dell strengths: a fully integrated motherboard, high-quality components (including a Seagate 450MB hard disk and a 15-inch monitor), thorough documentation, and excellent performance scores. These new OptiPlex machines are outstanding performers.

The 66-MHz model was easily the best system of the roundup, scoring highest overall on the DOS video tests (the 33-MHz OptiPlex ranked number two), second on the DOS disk tests, and fifth on the Disk WinMark tests. It had the best DOSmark showing, and the ninth highest Winstone score.

With excellent all-around performance, competitive pricing, a one-year parts-and-labor warranty, and 24-hour toll-free technical support, the OptiPlex PCs are worth close scrutiny.—OR

• **Dell Computer Corp.**, 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355. Circle 457 on reader service card

▶ Dell OptiPlex MXV

SUITABILITY TO TASK

DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	FAIR
Overall value	EXCELLENT

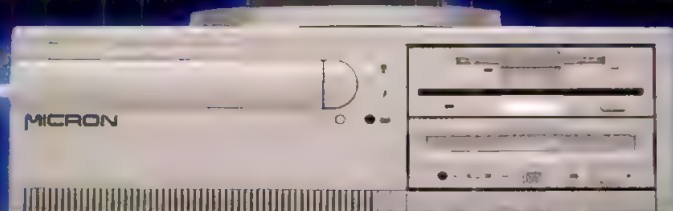
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graphics accelerator

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66MHz 486DX2
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2MB RAM
245MB HD

MICRON 466VL
\$2699
MAGNUM MPC

SoundBlaster 16
CD-quality audio

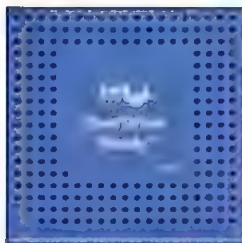
Real floppy drive
5.25"

280ms dual speed
MPC CD-ROM drive

Optional Altec Lansing ACS 300
speaker system with subwoofer

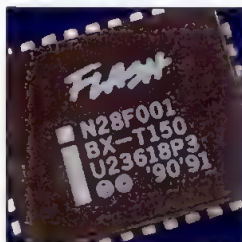


PENTIUM™ TECHNOLOGY READY



Standard on every Micron system is a Zero Insertion Force (ZIF) socket that makes upgrading to Intel's Pentium™ based OverDrive™ processors a snap! Heat's not a problem — Micron systems comply with Intel's stringent thermal dissipation guidelines.

256K 15ns CACHE & FLASH BIOS



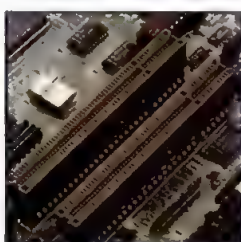
With 256K of ultra-fast Micron 15ns SRAM cache, your system's memory architecture will fully exploit future OverDrive processors. Plus, the upgradeable Flash BIOS lets you update your firmware from a floppy drive or modem.

DIAMOND VIPER ACCELERATOR



Powered by the Weitek P9000, the Viper VLB is up to 300% faster than the ATI Ultra Pro VLB. With 2MB of VRAM, you'll get 256 colors at 1280 x 1024 @ 74Hz and 16.7 million colors at 800 x 600. Turbo Windows and AutoCAD drivers included.

VESA LOCAL BUS W/BLOCK MODE



With 2 VESA local bus slots and an integrated 32-bit local bus IDE interface, you can have up to 3 local bus devices including bus mastering cards. The integrated local bus IDE interface features Block Mode Transfer (BMT), which provides a 20-30% performance increase.

MULTIMEDIA FROM MICRON



September 1993
466VL MAGNUM



January 26, 1993
466 MAGNUM

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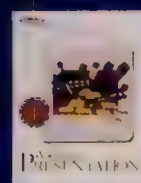
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The competition makes you pay extra for what Micron includes as standard equipment on all systems. The MPC compliant 280ms CD-ROM drive supports multisession Kodak photo CDs and plays all standard audio CDs.

WINDOWS NT™ READY-TO-RUN



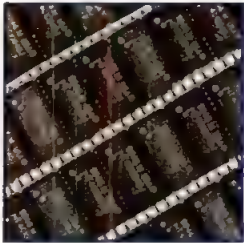
Microsoft's long-awaited Windows NT™ operating system is now available from Micron. The WinStation CD is available with Windows NT™ on CD-ROM and allows you to run all existing DOS and Windows applications while preparing you for tomorrow's 32-bit applications.

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433VL MAGNUM CD

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- Diamond SpeedStar Pro VLB (1MB)
- 14" MAG LX1450, 1024NI, .28mm
- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS 6 & Windows 3.1 on CD
- Choice of application software

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446VL MAGNUM MPC

- Intel 486DX2 66MHz processor
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- 256K 15ns cache, Flash BIOS
- 7 slots: 2 VESA, 7 ISA
- 280ms CD-ROM drive, 3.5" floppy
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- 15" MAG LX1564, 1280NI, .28mm
- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS 6 & Windows 3.1 on CD
- Choice of application software

\$2,799 LEASE - \$102/MO.

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- Intel 486DX2 66MHz processor
- Pentium Technology Ready (ZIF)
- 16MB RAM, 256K 15ns cache
- 340MB 14ms SCSI 2 HD (VLB)
- 280ms CD-ROM Drive, 3.5" floppy
- Diamond Stealth Pro VLB (1MB)
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- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- Microsoft Windows NT™ on CD
- Choice of application software

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466VL POWERSTATION CD

- Intel 486DX2 66MHz processor
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- 280ms CD-ROM drive, 3.5" floppy
- Diamond Viper VLB (2MB)
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- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS 6 & Windows 3.1 on CD
- Choice of application software

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466VLE MAGSERVER CD

- Intel 486DX2 66MHz processor
- Pentium Technology Ready (ZIF)
- 16MB RAM, 256K 15ns cache
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- Diamond SpeedStar Pro VLB (1MB)
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- Tower chassis with 7 drive bays
- Microsoft Mouse, 101-key keyboard
- MS-DOS 6 & Windows 3.1 on CD
- Choice of application software

\$3,799 LEASE - \$132/MO.

466VLE WINDO SERVER CD

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- Pentium Technology Ready (ZIF)
- 16MB RAM, 256K 15ns cache
- 527MB 10ms SCSI 2 HD (VLB)
- 8 slots: 2 VESA, 8 EISA
- 280ms CD-ROM drive, 3.5" floppy
- Diamond Viper VLB (2MB)
- 15" MAG LX1564, 1280NI, .28mm
- Tower chassis with 7 drive bays
- Microsoft Mouse, 101-key keyboard
- MS-DOS 6 & Windows 3.1 on CD
- Choice of application software

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466VLE DESIGNSTATION CD

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- Pentium Technology Ready (ZIF)
- 32MB RAM, 256K 25ns cache
- 1.2GB 10ms SCSI 2 HD (VLB)
- 8 slots: 2 VESA, 8 EISA
- 280ms CD-ROM drive, 3.5" floppy
- Diamond Viper VLB (2MB)
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CIRCLE 119 ON READER SERVICE CARD

Destiny Computers

Destiny Blitz 486SLC/2

Based on IBM's clock-doubled SLC/2 CPUs, the Destiny Blitz 486SLC/2 PCs are attractively priced. They are, however, only average performers.

The tested PCs—a 486SLC2/50 (\$2,250), a 486SLC2/66 (\$2,400), and a 486SLC2/80 (\$2,600)—use identical sturdy desktop cases, but had internal glitches, including jury-rigged power switches. Each motherboard has integrated I/O ports, IDE/floppy disk controllers, and six 16-bit ISA slots.

Unfortunately, video is relegated to a 16-bit CW31 Windows Accelerator card using Western Digital's 90C31 chip set, which hampered performance. The 14-inch Nokia monitors produced good images, but had loose control buttons.

Each Blitz unit performed adequately for the price. Processor scores for the SLC2/80 fell between those of a DX/33 and a DX2/50 CPU, while the SLC2/50 and SLC2/66 scored on a par with an SX/25 CPU and a DX/33 CPU, respectively.

Destiny Blitz 486SLC/2

SUITABILITY TO TASK

DOS applications	FAIR
Windows applications	FAIR
Expandability	FAIR
Overall value	FAIR

Video test scores were well below average, though disk scores were average within CPU class. Because of incompatibility, the three tested systems were unable to run the Winstone test.



Destiny Computers provides a three-year warranty on motherboards for units other than the SLC2/80. The other systems and the rest of the SLC2/80 have a one-year warranty.—OR

• **Destiny Computers**, 3480 Investment Blvd., Hayward, CA 94545; 800-337-8469.

Circle 458 on reader service card

Diamond Technologies Inc.

DT 486DX Versa

The DT 486DX Versa PCs, from Diamond Technologies, provide the performance of combination VL-Bus/EISA architecture along with plenty of expansion space at reasonable prices.



DT 486DX Versa

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT

The design of the SIC EISA/VESA motherboard follows this grab-all-the-power-you-can theme. Available processors are the 486DX2/66, 486DX/50, and 486DX2/50, from Intel; or the AMD Am486DX/40. The tested units, an AMD DX/40 (\$2,915)—a little more powerful than an Intel DX/33 on the processor test—and a DX2/66 (\$3,155) each come with a Viper VLB video card, a 4MB caching Promise VL-Bus hard disk controller, and a MAG MX15H monitor.

Both tested models showed average or slightly above average performance on all benchmark tests, except for DOS video, not surprising given the Windows-intensive Weitek Power 9000 chip set. Graphics WinMark scores for both, however, were among the roundup leaders. The Winstone score of the DX2/66 system was average for its processor, and the DX/40's performance was comparable with that of a DX/33 or DX2/50.

The Versa has a 15-month parts and two-year labor warranty. On-site service is \$75 for the first year.—OR

• **Diamond Technologies Inc.**, 1275 S. Lewis St., Anaheim, CA 92805; 800-989-7253.

Circle 459 on reader service card

Duracom Computer Systems

Duracom DeskSaver 486 EISA

Filling out the high-end of Duracom Computer Systems' offerings, the Duracom DeskSaver 486 EISA machines are aimed at the high-end workstation market. Though their prices are competitive for high-end systems, the DeskSaver EISA PCs are inconsistent performers.

At \$3,149 for the 486DX/33 and \$3,399 for the 486DX2/66 tested units, these PCs are in the running on price. Each has a high-end SCSI hard disk subsystem with 4MB of hardware cache, and



a 14-inch ADI MicroScan 3E+ display.

The one VL-Bus slot is filled with a VLB Mach32 video adapter. I/O ports are run off an 8-bit card, which takes up an extra EISA slot because the ports are hard-wired out the back of the neighboring slot. Messy cabling detracted from an otherwise clean design, and though the processor is user-upgradable, processor cache is not.

Each tested system performed unevenly, with processor and Graphics WinMark scores falling well-below average. These were balanced by good DOS disk results, especially for the DX2/66 model. DOS video and DOSmark scores were also good for both entries, but the DX/33 fell a little short on Disk WinMark and Graphics WinMark tests.

The DeskSaver EISA machines have a one-year parts-and-labor warranty with free on-site service.—OR

• **Duracom Computer Systems**, 1425 Greenway Dr., Irving, TX 75038; 800-551-9000.

Circle 460 on reader service card

Happy Holidays from Austin!

NEW!

Austin Power with Pentium™ Processor

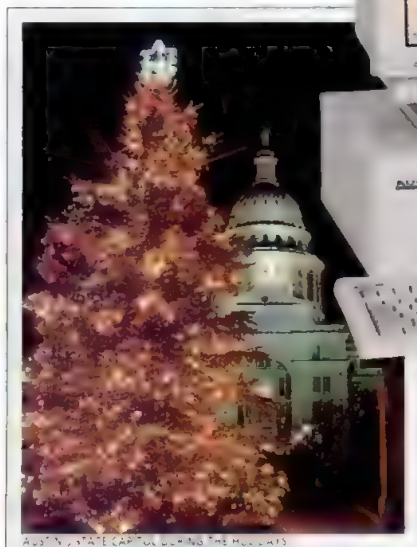
Austin makes Intel's fastest processor affordable!

With Austin Power, you don't have to compromise between affordability and performance. With its Pentium processor, 256 KB cache, and PCI local bus accelerated video controller with 2 MB of VRAM, this system's Windows performance is nothing short of phenomenal. The 525 MB 10ms hard drive and Sony double-spin CD-ROM drive have the capacity and speed for applications that demand Pentium processing power. The 15" digital monitor displays up to 1280 x 1024 pixels. With its multi-resolution memory, you never have to fiddle with monitor controls as you change applications. For the ultimate in productivity, get Austin Power.

Phenomenal!

Pentium™ Processor

SPECIAL HOLIDAY PRICE
\$3,999†



Austin is the place to go for the holidays.

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NEW!

486 MediaMagic™ Systems

Austin brings you the multimedia revolution!

While others are starting to add CD-ROM drives to their systems, Austin delivers a complete multimedia computing solution including the MediaMagic ISP-16 Audio Board, amplified speakers, Sony double-spin CD-ROM drive, and a selection of four CD-ROM titles. This system features the Intel 486SX-33 processor, local bus Windows accelerated video, 3.5" floppy drive, and 212 MB hard drive. Topped with our 14" Super VGA monitor, this system is perfect for home computing, education, or small office use.

Informative and Fun!

486SX-33

SPECIAL HOLIDAY PRICE
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The Ultimate Multimedia Machine!

Austin's MediaMagic Pro systems include the DSP-16 Plus Audio Board with digital signal processor and wavetable MIDI synthesis, the same technology used by professional musicians. This system includes a 340 MB hard drive and 1 MB VL-Bus Windows accelerator. The Toshiba 3401 double-spin CD-ROM drive offers the industry's fastest access time.

Multimedia Power!

486DX2-66

SPECIAL HOLIDAY PRICE
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† Promotional pricing.



486 for Home, Office or Dorm

Fast and Easy!

Never has so much power been so affordable. This 486SX-33 MHz system features accelerated local bus video and 212 MB hard drive. The preinstalled DOS and Windows software requires no installation, so you'll be creating letters, mailing lists, and budgets within minutes of opening the box! And our Energy Star™ design saves you money by using less electricity.

Great Value!

486SX-33

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Austin's 486 Performance Systems feature accelerated VL-Bus video with 1 MB of DRAM, dual floppy drives, larger chassis, 15" SVGA monitor, and ZIF socket for easy upgradability to Pentium™ technology. The 128 KB level 2 cache improves performance 19% over cacheless systems on DOS and Windows applications.

Best Buy!

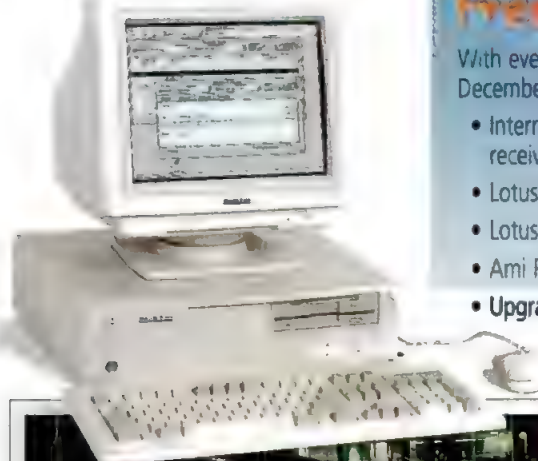
486DX2-66

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15" Digital Memory Non-Interlaced Super VGA Color Monitor
Compact Desktop Case
Three 5.25" HH Bays, Two Internal 3.5" Bays
200 Watt Power Supply
Four 16-Bit ISA, Two 64-Bit PCI, and One PCI/ISA Slot

Pentium	525 MB	10ms	IDE	\$3,999
Pentium	1.05 GB	10ms	SCSI	4,749

486 MediaMagic Systems

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Accelerated Local Bus Video with 512 KB DRAM
14" Super VGA Monitor
Low Profile Case
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Five 16-bit ISA Slots
Compatible with Sound Blaster and Windows Sound System
EPA Energy Star Approved Power Conservation

486SX-33	SVGA	212 MB	13ms	\$1,749
486DX-33	NI SVGA	250 MB	13ms	1,999
486DX-66	NI SVGA	340 MB	13ms	2,349

486 MediaMagic Pro Systems

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3.5" Floppy Drive
MediaMagic DSP-16 with Toshiba 200ms CD-ROM and Speakers
Super Accelerated Local Bus Video with 1 MB DRAM
15" Digital Memory Non-Interlaced Super VGA Color Monitor
Compact Desktop Case
Three 5.25" HH Bays, Two Internal 3.5" Bays
200 Watt Power Supply
Compatible with Sound Blaster and Windows Sound System
Four 16-Bit ISA and Two 32-Bit VESA/ISA Slots

486DX2-50	340 MB	13ms	\$2,749
486DX2-66	340 MB	13ms	2,999

486 For Home, Office, Dorm

4 MB RAM Expandable to 32 MB
3.5" Floppy Drive
Accelerated Local Bus Video with 512 KB DRAM
14" Super VGA Monitor
Low Profile Case
Two 5.25" HH Bays, One 3.5" Bay, One Internal 3.5" Bay,
150 Watt Power Supply
Five 16-bit ISA Slots
EPA Energy Star Approved Power Conservation

486SX-25	212 MB	13ms	\$1,299
486SX-33	212 MB	13ms	1,349

486 Performance Systems

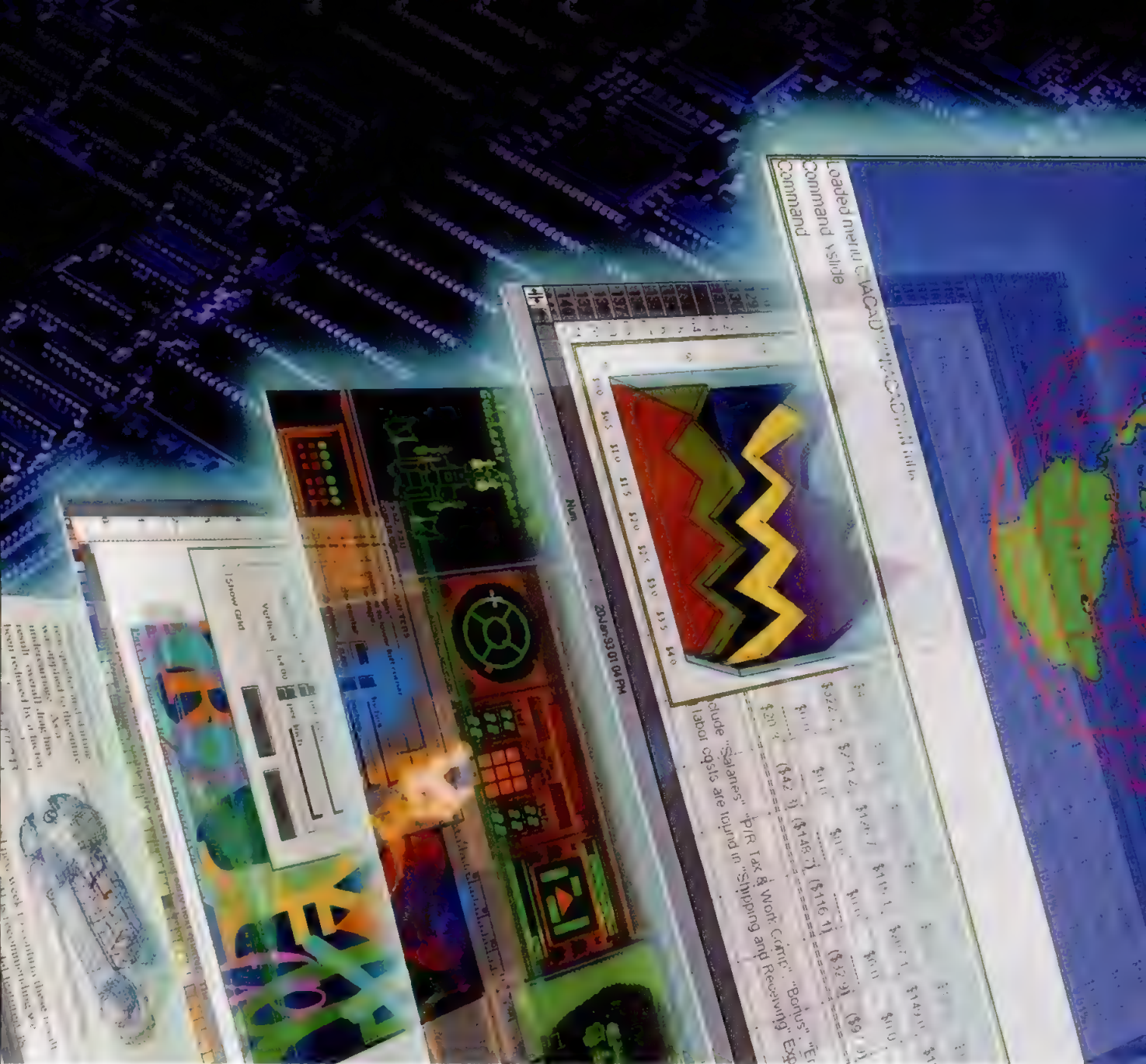
8 MB RAM Expandable to 64 MB
128 KB Level 2 Cache
Dual 5.25" and 3.5" Floppy Drive
STB Powergraph C33 VL-bus 1 MB Windows Accelerator
15" Digital Memory Non-Interlaced Super VGA Color Monitor
Desktop Case
Three 5.25" HH Bays, Two 3.5" HDD Bays
200 Watt High Efficiency Power Supply
Four 16-Bit ISA and Two 32-Bit VESA/ISA Slots

486DX2-50	340 MB	13ms	\$2,199
486DX2-66	425 MB	13ms	2,449

All Systems

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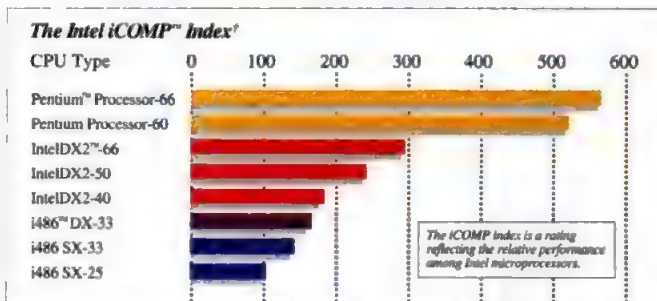


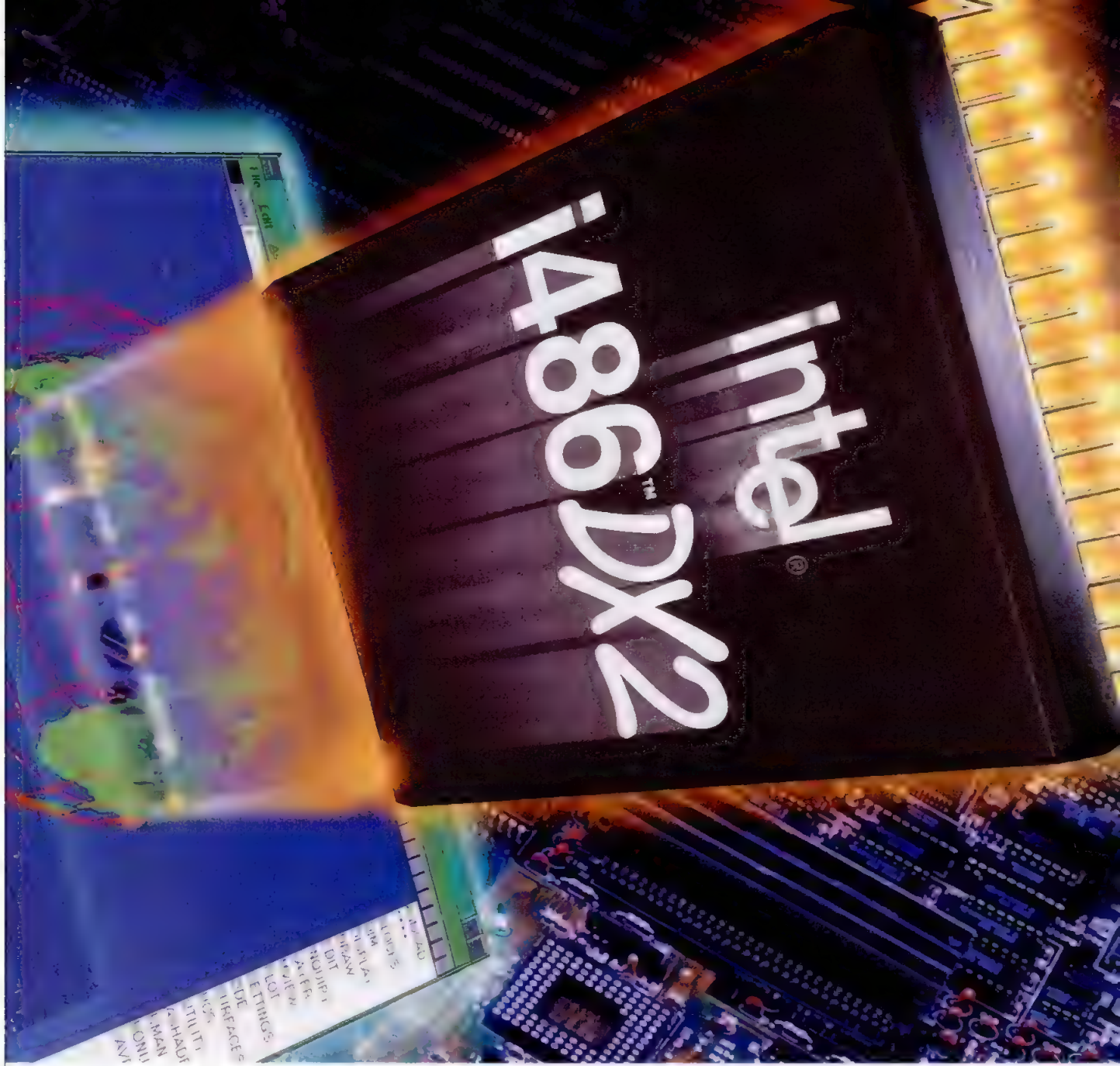
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Duracom Computer Systems

Duracom DeskSaver 486 VESA

The Duracom DeskSaver 486 VESA line is meant to appeal to both first-time and experienced PC customers. Unfortunately, these VL-Bus personal computers can only muster average to slightly be-



low-average performance at middle-of-the-road prices.

On the outside, the DeskSaver VESA PCs are identical to their Duracom DeskSaver 486 EISA cousins, right down to the 14-inch ADI MicroScan 3E+ monitor that comes with both lines. On the inside you'll find an ISA/VL-Bus motherboard that can accept up to 256K of external cache and 32MB of system memory. Inconveniently, the wiring for the I/O ports comes out the back of a neighboring expansion-board slot. This fairly common problem wastes that expansion slot.

Duracom DeskSaver 486 VESA

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	GOOD

Our tested computers, a 486SX/33 system (\$2,699) and a 486DX2/66 system (\$3,049), each achieved an average processor score. Ironically, the DX2/66 was able to outperform the DeskSaver EISA high-end unit in processor, DOS video, and DOSmark tests. DOS video scores for both DeskSaver VESA models were competitive, but on the Winstone test the SX/33 system was average for its class, while the DX2/66 system lagged slightly in its group.

The Duracom DeskSaver 486 VESA units carry a one-year parts-and-labor warranty and free on-site service.—OR

• **Duracom Computer Systems**, 1425 Greenway Dr., Irving, TX 75038; 800-551-9000.

Circle 460 on reader service card

Dyna Micro Inc.

Dyna Micro VL Business Systems

Using a combination VL-Bus/ISA motherboard, Dyna Micro VL Business Systems deliver robust performance at competitive prices to midrange-PC users.

Dyna Micro offers a choice from one of four CPUs: 486SX/25, 486DX/33, 486DX2/50, or 486DX2/66. We tested the DX/33 (\$2,695) and the DX2/66 (\$2,950) versions. Each is enclosed in a small-footprint case and has such features as a Genoa Systems VL-Bus graphics adapter, a 15-inch Adonics display, and a Promise Technology VL-Bus hard disk controller with 4MB of cache.

Inside, things are clean, and there are plenty of drive bays. The only shortcoming is the placement of the ZIF processor socket below the drive bay assembly. It is accessible in this position, but not easy to get to.

Performance for the tested units wasn't stellar when compared to the roundup leaders, but it was solid. DOS video and disk scores were well ahead of the crowd, especially for the DX2/66 model, which had a fifth-place DOSmark score. Most other scores for both systems were in the middle or slightly above; the exception was the Graphics WinMark



score, which was a tad below the mark for both tested Dyna Micro VL units.

Included is a one-year parts-and-labor warranty and support by phone (business hours) or BBS (24 hours). On-site service is an additional \$49 per year —OR

• **Dyna Micro Inc.**, 30 W. Montague Expwy., San Jose, CA 95134; 800-362-3962.

Circle 461 on reader service card

Eltech Research Inc.

Eltech Splendor

Eltech Research jumps on the low-cost 486-clone processor bandwagon using the IBM-made Alaris Leopard motherboard. As against Intel-based units of the same clock speed, there's a clear perfor-



mance lag, but the Eltech Splendor line is among the best low-cost PCs around.

The \$2,399 SLC-2/50 comes in a sturdy desktop case, while the \$2,649 SLC-2/66 is in a mini-tower. Either case offers plenty of expansion room and 250-watt power supplies. Eltech installed Alaris's own Patriot II VESA local-bus IDE hard disk adapter with built-in I/O ability. The system handles up to 64MB of RAM, and a 128K external cache option is available. Video is handled by an Alaris VL-Bus Tomahawk chip set integrated on the motherboard with 1MB of video RAM.

Performance throughout was barely adequate. Processor scores for the SLC2-50 and SLC2-66 were in line with the average scores for Intel SX/25 and SX/33 chips. Benchmark test scores here were below average, but Winstone test performance made both units about even with an average DX/33.

Disappointing documentation in the manual gives no mention of Eltech or any other vendor; illustrations only loosely correspond to the system. Alaris has a three-year warranty on its motherboard, while Eltech backs its unit with a one-year parts-and-labor warranty.—OR

• **Eltech Research Inc.**, 48890 Milmont Dr., #108D, Fremont, CA 94538; 800-358-8330.

Circle 462 on reader service card

Daisy
Dahlia
Rose
Tulip
Orchid

New brilliant Active Matrix display - 640 x 480 VGA with high-speed video system for lightning fast graphics

The notebook industry's first 4mm, full-travel keyboard with the look and feel of a desktop system.

Built-in Windows plus 50MHz 486DX2 processor (with coprocessor) for blazing performance.

Texas Instruments
TravelMate 4000E
486 WinDX2/50MHz
Active Matrix Color

ACTIVE COLOR.
486DX2 50MHz POWER.
WINDOWS IN 15 SECONDS.
HEY, WHAT ARE YOU
WAITING FOR?

If you've been waiting for an active matrix color notebook with true desktop power, your wait is over. Thanks to the new TravelMate™ 4000E WinDX2™/50 Active Matrix Color notebook from Texas Instruments.

50MHz DX2 processor with coprocessor provides desktop performance in a notebook.

With 256 brilliant, simultaneous colors and a 50MHz 486DX2 processor, this powerhouse doesn't just whisper color, it screams it.

And yet the TravelMate 4000E weighs a mere 6.2 pounds, including battery. This convenient size and weight gives you more performance* than the leading 486 notebooks. And the industry's first 4mm, full-travel keyboard gives you the feel of a desktop.

Of the leading active matrix color notebook manufacturers, only TI offers the desktop performance of a 50MHz DX2 processor.

Active Color Notebook	Weight (lbs.)	486 Processor	Speed	Coprocessor
TravelMate 4000E	6.2	DX2	50MHz	Yes
Toshiba T4600C	6.9	SL	33MHz	Yes
Compaq LTE Lite 4/33c	6.5	SL	33MHz	Yes
IBM ThinkPad 720C	7.6	SLC2	50MHz	No

Thanks to built-in Windows 3.1 and useful TI utilities, you can power up to Windows in just 15 seconds. And the TravelMate

4000E is Windows NT-compatible. With 4MB of main memory, expandable to 20MB, you're ready for today's and tomorrow's software.

If you work on the go, you'll also go for the rugged 200MB hard disk drive, the high-speed videobus and 1MB of video RAM, as well as the full range of connectivity options - snap-on modules for Ethernet® LANs, SCSI-compatible devices and an internal 14,400 bps V.32 bis modem with 9,600 bps send/receive fax capability.

For more information about the only 486 notebook family that won five Editor's Choice awards in PC Magazine's August issue, call 1-800-527-3500.

TI TravelMate 486DX2 Notebooks



EXTENDING YOUR REACH
WITH INNOVATION™

**TEXAS
INSTRUMENTS**

*Based on industry standard application performance speed tests. TravelMate, WinDX2 and "Extending Your Reach With Innovation" are trademarks of Texas Instruments. Ethernet is a registered trademark of Xerox Corp. The Intel Inside logo is a trademark of Intel Corp. ©1993 TI

CIRCLE 139 ON READER SERVICE CARD

Epson Direct

Epson Endeavor WG

The Epson Endeavor WG line, sold exclusively through the new Epson Direct subsidiary, is aimed at budget-conscious power users. Its only shortcomings are a lack of expansion space and mediocre performance scores.

You'll find anything in the Endeavor's small-footprint case from an Intel SX/33 (\$2,745) to a DX2/66 (\$3,165). But you won't find room. The two external drive bays are taken up by floppy disk drives and the internal bay by the hard disk.

Epson Endeavor WG	
SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	POOR
Overall value	FAIR

I/O, video, and IDE and floppy disk drive circuitry are all run off the motherboard, leaving the four 16-bit ISA slots free. The motherboard's only fault is a maximum of 36MB of RAM on-board. Mirroring Dell's approach, Epson



includes extra manuals: a "Getting Started Guide," a booklet called "Creating a User-Friendly Workstation," and a booklet on installing drivers and utilities. Epson includes all the

necessary extras, but Endeavor wasn't able to make the combination fly. The performance of both Endeavor units was blessed with strong DOS disk scores, but results were average to below-average on most other tests—DOS video being especially low. The PCs were unable to run our Winstone test.

Toll-free technical support is available during business hours, or over a 24-hour BBS service. A one-year parts-and-labor warranty covers on-site service.—OR

• **Epson Direct**, 20770 Madrona Ave., Torrance, CA 90503; 800-374-7300.
Circle 464 on reader service card

Epson America Inc.

Epson Progression 4

In its hardware, Epson America's Epson Progression 4 line is similar to the Epson Endeavor WG line. The main difference is that the Progression is priced lower and sold through Epson's retail channel,



while the Endeavor WG remains a direct-only product.

Though performance scores were similar to the Endeavor, the Progression does hold one simple but valuable edge over the Endeavor: the inclusion of a dual-media floppy disk drive. This small variance frees one precious external drive bay for whatever upgrade a user may desire. Even slimline computers should be able to upgrade a little.

Aside from this small birth mark, the twins remain the same. The motherboard sports the same high level of integration; the Progression's monitor and documentation is also the same. Performance for the DX2/50 (\$3,120) the and DX2/66 (\$3,239), though not precisely identical, showed the same trends of good DOS disk scores marred by below-average processor and DOS video results with mediocre numbers coming from the rest of the benchmark tests. Unfortunately, due to a hardware incompatibility, the Progression could not run the Winstone test.

A one-year parts-and-labor warranty with on-site service and toll-free technical assistance is also provided with the Progression.—OR

• **Epson America Inc.**, 20770 Madrona Ave., Torrance, CA 90503; 800-289-3776.
Circle 463 on reader service card

Epson Progression 4

SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	FAIR
Overall value	FAIR

Everex Systems Inc.

Everex Step VL EISA

The Everex Step VL EISA line offers standard fare for users seeking desktop power. With high-end hardware, it earned strong, no-surprises performance scores at slightly above-average cost.

Many vendors offered EISA PCs in our tests at about \$3,500 for a 486DX2/66 CPU, but Everex Systems could only do \$4,231 for a DX2/66 and \$3,909 for a DX/33. For the extra cost you get a spacious desktop case allowing seven EISA slots and one with a VESA local-bus extension. There is also a 200-watt power supply and five drive bays.

Design shortcomings are few, such as an 8-bit I/O card in an era of motherboard integration. Performance was competitive in all areas, but it was outstanding in a few. The DX2/66 model managed some exceptional numbers, including high disk scores for the combination Seagate 528MB disk and 2MB caching EISA drive controller and fifth place in the processor category. But the Everex really stood out for its Windows graphics with a Weitek P-9000 chip set in a Viper VLB video card. It nearly set the pace with the second-fastest Graphics WinMark score. Overall, the Everex system had an excep-

Everex Step VL EISA

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	GOOD
Overall value	GOOD



tional Winstone showing, making it a good choice for Windows-intensive work.

Everex offers an attractive two-year parts-and-labor warranty and one-year on-site service.—OR

• **Everex Systems Inc.**, 901 Page Ave., Fremont, CA 94538; 800-952-1556.
Circle 465 on reader service card

First Computer Systems Inc.

FCS President PAK VLB

Power users on a budget, take heed: First Computer Systems' FCS President Pak VLB packs a lot of performance and features into a low price.

In full-size tower cases, First's two Presidents came in 486DX/33 (\$2,699) and DX2/66 (\$2,999) units. Six external drive bays were complemented by a 250-watt power supply and space for more internal bays. Encased inside were VL-Bus video and a caching VL-Bus

hard disk controller, a Western Digital 340MB disk, a Pentium OverDrive socket, and external processor RAM cache expandable to 1MB.

The one system flaw was the motherboard combining five 16-bit ISA slots with one 32-bit EISA and two more EISA slots with VL-Bus extensions. Though not a crucial issue, the extra cost of the EISA slots seems unnecessary, as no

cards use both VESA and EISA buses simultaneously.

Performance was respectable and then some, but was mixed. Processor, DOSmark, Disk WinMark, and Winstone scores were average for each system's CPU class. DOS video scores were below average, while DOS disk and Graphics WinMark scores were above average.

First offers a two-year parts-and-labor warranty marred only by a \$50 fee for one-year on-site service.—OR

• **First Computer Systems Inc.**, 6000 Live Oak Parkway, Suite 107, Norcross, GA 30093; 800-325-1911.

Circle 466 on reader service card



FCS President PAK VLB

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	EXCELLENT

SUMMARY OF FEATURES

CONTINUES

The 486 Buyers' Guide

Price range refers to the range of prices from a low-end system, such as a 486SX/25, to a high-end system, such as a 486DX2/66 or Pentium processor. These prices represent our "standard configuration" as applied to all the 486 models in each product line. Some vendors are moving away from set list prices and are instead using estimated selling prices to approximate more closely what you'd pay.

Dealers/Direct-distribution channel Various machines are sold directly through mail order, through dealers, or, increasingly, through company-owned stores and superstores. For machines sold through dealers, *PC Magazine* views a 15 percent discount off the suggested retail price as typical.

Bus architecture refers to the expansion bus used in each family of PCs: *ISA* (Industry Standard Architecture), *EISA* (Extended Industry Standard Architecture), and *MCA* (Micro Channel architecture), though the latter is generally restricted to servers and advanced workstations. In addition, many lines are also sporting a local bus: either VESA's VL-Bus or some proprietary scheme.

The **power supply (and number of connectors)** can affect the future expandability of a PC.

The **chip set manufacturer** makes the logic that connects the CPU with the other functions managed by the system board.

The **BIOS version (or date)** can affect a system's performance on *PC Magazine Labs'* benchmark tests. A PC with another BIOS may perform differently.

Flash memory contains BIOS code that can be updated via software. The BIOS is generally stored in conventional ROM, which has no provision for modification.

Installable RAM on motherboard indicates the amount of memory that can be installed using any combination of chips and proprietary cards.

Installable external RAM cache indicates the range of processor cache available. This cache speeds operation and is in addition to Intel's 8K, Cyrix's 2K, and IBM's 16K of internal cache on 486 processors.

Accessible drive bays can be reached from a system's front panel and can support removable media (such as tape drives and CD-ROMs); **internal drive bays** can be reached only by opening the case. We report the maximum number of accessible and internal drives a system can hold (with separate entries for 5.25-inch and 3.5-inch bays).

Hard disk options We report the range of hard disk capacities offered in each line. A system's expansion bus determines what expansion connections will be available.

Disk controller cache We report the amount of cache on each system's hard disk controller, which may affect disk performance results.

Disk controller location A system that comes with IDE circuitry has its controller functions integrated onto the disk and motherboard or through a separate pass-through controller. Disk controllers may be on a system's expansion bus, regardless of whether it is an ISA, EISA, or MCA bus. An increasing number of disk controllers reside on local buses.

We report the number of **8-bit, 16-bit, and 32-bit expansion slots** in the systems.

The **display circuitry** can reside on an expansion card or on a PC's motherboard. Motherboard circuitry is often faster, but if it cannot be disabled, there is no way to upgrade it. For each local bus, we report whether the bus is based on PCI specifications, the VESA (VL-Bus) specification, or a proprietary system ("motherboard LB").

The **video chip set manufacturer** makes the logic that runs the video adapter

DOS 5.0/Windows 3.1/other software included We indicate whether these software packages come standard with each system. Where the software is not included in the standard bundles, it may be available at extra cost.

The **on-site service charge** may be included in the price of a system, or it may be a set or variable added cost. If the charge varies, it is often determined by a system's configuration and cost

► SUMMARY OF FEATURES

The 486 Buyers' Guide

Products listed in alphabetical order by company

■ = YES □ = NO

Price range
Range of processors available

Dealers/Direct-distribution channel

Case style

Bus architecture

Power supply (and number of connectors)

Motherboard manufacturer

Chip set manufacturer

BIOS version (or date)

Flash memory

Installable RAM on motherboard

Installable external RAM cache

Accessible drive bays (5.25", 3.5")

Internal drive bays (5.25", 3.5")

Hard disk options

Disk controller cache

Disk controller location

8-bit, 16-bit, 32-bit slots

VESA, PCI, proprietary slots

Parallel, serial, mouse ports

Display circuitry location

Video chip set manufacturer

DOS 6.0/Windows 3.1/Other software included

Warranty

On-site service charge

Aberdeen Inc.	Aberdeen Inc.	Acer America Corp.	Acer America Corp.	Acer America Corp.	ACMA Computers Inc.	ACMA Computers Inc.	ACMA Computers Inc.
Aberdeen Mini EISA VLB	Aberdeen Super EISA VLB	Acer Acros	Acer Power 486	Acer Power 486v	ACMA ISA Series	ACMA VESA/ISA Series	ACMA VESA/ISA Series
\$2,699-\$3,149	\$5,275-\$5,725	\$2,299-\$2,849	\$3,349-\$3,649	\$2,644-\$2,999	\$2,595-\$2,990	\$3,100-\$3,495	\$2,895-\$3,290
Intel 486SX/25-486DX/66	Intel 486SX/25-486DX/66	Intel 486SX/25-486DX/66	Intel 486DX/33-486DX/66	Intel 486DX/33-486DX/66	Intel 486SX/33-486DX/66	Intel 486SX/33-486DX/66	Intel 486SX/33-486DX/66
□	□	■	■	■	■	■	■
Mini-tower	Tower	Small-footprint	Desktop	Desktop	Mini-tower	Tower	Tower
EISA	EISA	ISA	EISA	ISA	ISA	EISA	ISA
230W (4)	300W (8)	145W (4)	200W (4)	200W (4)	250W (6)	250W (6)	250W (6)
MCCI	MCCI	Acer	Acer	Acer	Helm Engineering	Helm Engineering	Helm Engineering
Hint	SIS	Acer	OPTi	SIS	SIS	SIS	SIS
AMI (2/17/93)	AMI (6/6/92)	Acer 1.2R1.3	Acer 1.2R1.2	Acer 1.2R1.1	AMI (5/5/91)	Award (6/3/93)	AMI (11/11/92)
□	□	■	■	■	□	□	□
1MB-128MB	1MB-256MB	4MB-68MB	4MB-256MB	4MB-64MB	1MB-128MB	1MB-128MB	1MB-32MB
256K-1MB	256K-1MB	Up to 256K	128K-256K	Up to 256K	64K-256K	64K-256K	64K-256K
3, 0	4, 0	2, 1	3, 1	3, 1	2, 2	4, 0	4, 0
0, 2	0, 3	0, 1	0, 2	0, 2	0, 1	2, 2	2, 2
256MB-545MB	345MB-1.9GB	170MB-340MB	240MB-520MB	240MB-520MB	80MB-1.4GB	80MB-1.4GB	80MB-1.4GB
2MB	4MB	None	None	None	2.5MB	2MB	4MB
VL-Bus card	EISA card	Motherboard	EISA card	Motherboard	ISA card	EISA card	VL-Bus card
0, 5, 1	0, 0, 7	0, 2, 0	0, 2, 5	0, 6, 0	1, 7, 0	0, 0, 7	0, 5, 0
2, 0, 0	1, 0, 0	2, 0, 0	0, 0, 1	2, 0, 0	0, 0, 1	1, 0, 0	2, 0, 0
1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0
VL-Bus card	VL-Bus card	Motherboard LB	ISA card	VL-Bus card	ISA card	VL-Bus card	VL-Bus card
Weitek	Weitek	Cirrus Logic	ATI	Weitek	ATI	S3	Weitek
■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
1 year parts, lifetime labor	1 year parts, lifetime labor	1 year	1 year	1 year	1 year	1 year	1 year
N/A	N/A	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)

① Upgrading a Compaq Presario above the 486SX/25 level requires the purchase of a separate CPU. ② Products in this line come with DOS 6.1. N/A-Not applicable: The product does not have this feature.

FutureTech Systems Inc.

FutureTech System 4XXeV

FutureTech Systems, trying to appeal to as large an audience of users as possible, has constructed its FutureTech System 4XXeV line with all the features and components for advanced applications—but at prices more in line with many mid-range personal computers in the review.

Each unit is housed in a spacious tower case that incorporates EISA, ISA, and VESA technologies. Each uses a caching VESA local-bus hard-disk controller and high-resolution video adapters with 2MB of video RAM. The motherboard can accommodate 256MB of RAM on-board. For this review we tested the \$2,989 486SX/25 and \$3,379



486DX2/66. Each holds four accessible and two internal 5.25-inch drive bays and a 340MB IDE hard disk, expandable to 2.4GB.

FutureTech System 4XXeV	
SUITABILITY TO TASK	
DOS applications	G00D
Windows applications	G00D
Expandability	G00D
Overall value	G00D

showing. A low DOS video score was balanced by an above-average Winstone score, making this system more appropriate for Windows applications.

A 15-month parts-and-labor warranty is offered. There's a \$59 fee for first-year on-site service.—OR

• **FutureTech Systems Inc., Six Bridge St. (Bridge Plaza), Hackensack, NJ 07601; 800-275-4414.**

Circle 467 on reader service card

Gateway 2000

Gateway 2000 VESA Local-Bus Line

Vying for the PC mail-order throne, the Gateway 2000 VESA Local-Bus Line is attractively priced and can be configured over such a broad performance spectrum that it should attract mainstream users and power users alike.

We tested a \$2,435 486DX/33, a \$2,655 486DX2/50, and a \$2,995 486DX2/66. The DX2 systems used ATI Graphics Ultra Pro cards and included Gateway's CD-ROM upgrade, while the DX/33 had a Diamond Computer SpeedSTAR adapter and no CD-ROM.

All three units shipped with Gate-



Advanced Logic Research Inc. ALR Evolution IV ISA	Ambra Computer Corp. Ambra Desktop	American Multisystems AM Integold EISA VLB Line	American Multisystems AM Integold VLB Line	AST Research Inc. AST Advantage Plus TLC	AST Research Inc. AST Bravo LP	AST Research Inc. AST Promise	Austin Computer Systems Inc. 486 Performance Systems	Axix Computer Inc. Axix Ace Cache 486V	Axix Computer Inc. Axix Ace Cache 486V/Pro
\$3,425-\$4,017	\$2,419-\$2,819	\$3,299-\$4,599	\$2,499-\$2,899	\$2,742-\$3,342	\$2,633-\$3,461	\$3,366-\$4,016	\$2,799-\$3,099	\$2,148-\$2,598	\$2,448-\$2,898
Intel 486SX/33-486DX/66	Intel 486SLC/60-Intel 486DX/66	Intel 486DX/33-Pentium	Intel 486DX/33-486DX/66	Intel 486DX/33-486DX/66	Intel 486SX/25-486DX/66	Intel 486SX/33-486DX/66	Intel 486DX/33-486DX/66	Intel 486SX/25-486DX/66	Intel 486SX/25-486DX/66
Small-footprint ISA	Desktop ISA	Tower EISA	Mini-tower ISA	Mini-tower ISA	Small-footprint ISA	Small-footprint ISA	Desktop ISA	Tower ISA	Tower ISA
270W (4)	200W (6)	230W (4)	200W (4)	205W (4)	61W (3)	200W (4)	200W (5)	250W (6)	250W (6)
ALR	IBM	AIR	Free Technology	AST	AST	AST	BMC	Axix	Axix
OPTI	FTD	SIS	SIS	VLSI	VLSI	TI	SJS	SJS	SJS
Phoenix 1.02/DM	Phoenix 1.03	AMI (6/5/92)	AMI (6/5/92)	AST 1.0	AST (4/30/93)	AST 1.04	AMI (6/5/92)	AMI (11/11/92)	AMI (11/11/92)
4MB-52MB	4MB-64MB	1MB-256MB	1MB-32MB	2MB-64MB	2MB-64MB	2MB-128MB	1MB-32MB	1MB-32MB	1MB-32MB
256K	256K	256K	256K	Up to 256K	256K	128K-512K	64K-256K	Up to 256K	Up to 256K
2.1	0.2	4.0	2.2	4.0	1.1	3.0	3.0	4.0	4.0
8.2	0.1	3.9	0.1	0.2	0.1	0.2	0.2	2.4	2.4
170MB-535MB	125MB-440MB	120MB-1.2GB	120MB-1.2GB	340MB-420MB	170MB-520MB	80MB-1GB	170MB-1.05GB	234MB-1.7GB	234MB-1.7GB
None	None	4MB	4MB	None	None	None	None	None	1MB
Motherboard	Motherboard	EISA card	VL-Bus card	Motherboard	Motherboard	Motherboard	VL-Bus card	VL-Bus card	VL-Bus card
0.5, 0	0.5, 0	0.0, 5	1.4, 0	0.6, 0	0.2, 0	0.0, 5	2.4, 0	0.6, 0	0.6, 0
2.0, 1	2.0, 0	3.0, 0	3.0, 1	None	None	None	2.0, 0	2.0, 0	2.0, 0
1.2, 1	1.2, 1	1.2, 0	1.2, 0	1.2, 1	1.2, 1	1.2, 1	1.2, 0	1.2, 0	1.2, 0
VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	Motherboard LB	Motherboard LB	Motherboard LB	VL-Bus card	VL-Bus card	VL-Bus card
ATI	WD	Westek	Westek	ATI	ATI	ATI	S3	S3	Westek
5 years parts, 15 months labor	1 year	1 year	1 year	1 year	3 years	3 years	2 years	1 year	1 year
\$9.95 (1 year)	Included (1 year)	N/A	N/A	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)

AIR-Advanced Integrated Research Inc., AMI-American Megatrends Inc., C&T-Chips & Technologies Inc., ECS-Elitegroup Computer Systems Inc., FTD-Future Technology Devices, HP-Hewlett-Packard Co.,

IT-Integrated Information Technology, MCCI-Micro Center Computer Inc., PCG-Personal Computer Graphics Corp., SIS-Silicon Integrated Systems Corp., TI-Texas Instruments Inc., UMC-United Microelectronics, WD-Western Digital Corp.

way's 15-inch CrystalScan monitor. All also carried ZIF sockets. The CD-ROM-equipped systems came with Gateway's System CD, which contains documenta-

tion and Windows 3.1 multimedia programs. You also have the choice of one application from Microsoft or Borland International, making it the value choice.

Performance for all three Gateway entries

was acceptable but not outstanding. Processor scores were slightly low for the DX2 systems and average for the DX/33. All other scores were either average or slightly above average.

Gateway offers a one-year parts-and-labor warranty with on-site service.—OR
• **Gateway 2000, 610 Gateway DR., P.O. Box 2000, No. Sioux City, SD 57049-2000; 800-846-2000.**

Circle 468 on reader service card

Golden Star Technology

GST 486V

Golden Star Technology is trying to attract attention and business by attacking the low end of the market with an inexpensive line of combination ISA/VL-Bus systems. Priced a bit less than similar units from other vendors, GST 486V

Each of these units includes an ISA-based Micronics motherboard that supports two VL-Bus connections. One local-bus slot is taken up by the S3-based video chip set in a Diamond Stealth 24VL video card that comes with 1MB of video RAM. The other local-bus slot is used for a Promise DC-2000 hard disk



controller and 340MB Western Digital drive.

Housed in a small-footprint case, each model has four drive bays and seven expansion slots. At \$2,599 for the 486DX/33 and \$2,899 for the DX2/66, these units are priced around \$200 less than most in this crowded field.

Performance was even under both DOS and Windows. Both the systems' DOSmark and Winstone ratings were above average, if only slightly. The only upward spike came in DOS video, where the the DX/33 and DX2/66 both turned in exceptionally high numbers.

A one-year parts-and-labor warranty is offered, but on-site service isn't available.—OR

• **Golden Star Technology, 17707 Valley View Ave., Cerritos, CA 90701; 800-675-2489.**

Circle 469 on reader service card

Gateway 2000 VESA Local-Bus Line

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT

GST 486V

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	FAIR
Overall value	EXCELLENT

SUMMARY OF FEATURES

Products listed in alphabetical order by company

■ = YES □ = NO

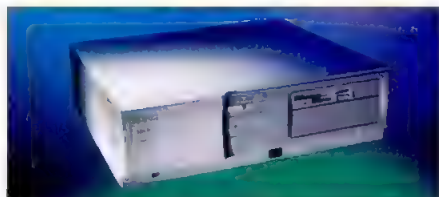
	Axix Computer Inc. Axix Ace Cache Ultimate SCSI-II	Blue Star Marketing Inc. Blue Star 486 VLB Pro Series	C² Micro Systems Inc. C² Saber 486 VL	CAF Technology Inc. CAF VL-Bus Series	Compaq Computer Corp. Compaq Deskpro/L	Compaq Computer Corp. Compaq Deskpro/M	Compaq Computer Corp. Compaq Presario	Compaq Computer Corp. Compaq ProLinea
Price range	\$2,948-\$3,398	\$2,399-\$2,649	\$1,885-\$2,300	\$3,797-\$4,653	\$2,741-\$3,376	\$3,520-\$6,399	\$1,819-\$2,538	\$2,045-\$3,094
Range of processors available	Intel 486SX/25-486DX/66	Intel 486DX/33-486DX/66	Intel 486SX/25-486DX/66	Intel 486DX/33-486DX/66	Intel 486SX/25-486DX/66	Intel 486SX/25-Pentium/66	Intel 486SX/25-486DX/66	Intel 486SX/25-486DX/66
Dealers/Direct-distribution channel	□ ■	□ ■	■ ■	■ □	■ ■	■ ■	■ ■	■ ■
Case style	Tower	Mini-tower	Mini-tower	Tower	Slimline	Small-footprint	Integrated desktop	Slimline
Bus architecture	ISA	ISA	ISA	ISA	ISA	EISA	ISA	ISA
Power supply (and number of connectors)	250W (0)	230W (5)	200W (5)	200W (4)	146W (4)	240W (4)	53W (2)	145W (4)
Motherboard manufacturer	Axix	Tyan	MCCI	CAF	Compaq	Compaq	Compaq	Compaq
Chip set manufacturer	SIS	SIS	OPTI	SIS	TI	Compaq	VLSI	VLSI
BIOS version (or date)	AMI (11/11/92)	AMI (11/11/92)	AMI (6/6/92)	AMI (11/11/92)	Compaq (3/8/93)	Compaq (5/21/92)	Compaq (6/30/93)	Compaq (2/18/93)
Flash memory	□	□	□	□	■	□	□	□
Installable RAM on motherboard	1MB-32MB	4MB-32MB	1MB-32MB	1MB-32MB	1MB-32MB	1MB-64MB	4MB-20MB	1MB-32MB
Installable external RAM cache	Up to 256K	128K-1MB	64K-256K	0-64K	0-64K	Up to 256K	None	None
Accessible drive bays (5.25", 3.5")	4, 0	2, 2	2, 2	3, 0	1, 1	3, 0	0, 1	1, 1
Internal drive bays (5.25", 3.5")	2, 4	0, 1	0, 1	2, 0	1, 0	0, 1	0, 1	0, 1
Hard disk options	234MB-1.7GB	130MB-2GB	120MB-1.2GB	171MB-1.23GB	120MB-510MB	120MB-2.1GB	200MB	84MB-340MB
Disk controller cache	1MB	None	None	4MB	None	None	None	None
Disk controller location	VL-Bus card	VL-Bus card	ISA card	VL-Bus card	Motherboard	Motherboard	Motherboard	Motherboard
8-bit, 16-bit, 32-bit slots	0, 5, 0	2, 3, 0	1, 5, 0	0, 7, 0	0, 3, 0	0, 0, 5	0, 2, 0	0, 3, 0
VESA, PCI, proprietary slots	2, 0, 0	2, 0, 0	2, 0, 0	2, 0, 0	None	0, 0, 1	None	0, 0, 1
Parallel, serial, mouse ports	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 1	1, 1, 1	1, 2, 1
Display circuitry location	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	Motherboard	EISA card	Motherboard	Motherboard
Video chip set manufacturer	Wetek	S3	Tseng	Cirrus Logic	Compaq	Compaq	Cirrus Logic	Tseng
DOS 6.0/Windows 3.1/Other software included	■ ■ □	■ ■ ■	■ ■ □	■ ■ □	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Warranty	1 year	3 years	1 year	1 year	3 years	3 years	3 years	3 years
On-site service charge	Included (1 year)	\$49 (1 year)	\$50 (1 year)	N/A	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)

Hewlett-Packard Co. HP Vectra XM

The recently introduced HP Vectra XM line, from Hewlett-Packard Co., sits at the pinnacle of the company's products. HP also sells a lower-performance Vectra VL line at less cost.

In standard desktop configurations at \$3,584 and \$4,154 for a DX/33- and DX/66-based unit, the XM line has a host of special features, such as internal ethernet connection for easy LAN communications, attractive to high-powered business users. Connecting to HP portables is provided for with an infrared communications link for easy file transfers; the XM also comes with a built-in PCMCIA reader card. Combine these extras with HP's high standards for hardware excellence and the price makes the XM a good high-end value.

Looking inside the XM, you'll be pleased by a remarkably clear and easily accessible interior and a simple



no-tools way of getting inside and around your PC. The unit's documentation complements this with clear, well-illustrated manuals.

Performance was also outstanding. Both systems earned some of the highest scores in the roundup, especially the DX2/66 model, which topped the DOS video, Disk, DOSmark, Disk WinMark, and Winstone tests and had very respectable scores elsewhere. The DX/33 model didn't earn quite so many finalist scores but was average on DOS video and disk tests.

HP offers a solid three-year parts-and-labor warranty and one-year of on-site service with the Vectra XM.—OR

• **Hewlett-Packard Co., 3000 Hanover, Palo Alto, CA 94086; 800-322-4772.**

Circle 470 on reader service card

HiQ Systems Inc. HiQ Ultra-Graphics Station

Though the video performance of the tested HiQ Ultra-Graphics Station models was excellent, the line's name is somewhat of a misnomer. At \$2,519 for the 486DX/33 unit and \$2,739 for the 486DX2/66 model, *Ultra Value* might have been a more appropriate moniker.

These are solid systems that offer a lot for the money. Both comprise EISA/VL-Bus motherboards carrying 256K of external cache, as well as VL-Bus video and caching IDE hard disk controllers. HiQ has cut some corners to keep costs low, but it has apparently done so without compromising features.

Unfortunately, this didn't fully translate into all around top performance. The Genoa card with its Cirrus Logic video



PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE	PC MAGAZINE EDITORIAL CHOICE
CompuDyne Products CompuDyne 486 Desktop \$2,299-\$2,899 Intel 486SX/33- 486DX/66 ■ ■ ■ Small-footprint ISA 200W (5) SCI OPTi AMI (6/6/92) □ 1MB-32MB Up to 256K 3, 0 0, 2 130MB-540MB None Motherboard Q, 6, 0 1, 0, 0 1, 2, 0 VL-Bus card Weitek ■ ■ ■ □ 1 year Included (1 year)	Contrade EISA VL-Bus Professional \$3,645-\$3,895 Intel 486DX/33- 486DX/66 □ ■ ■ Tower EISA 250W (5) AMI SIS AMI (12/12/91) □ 1MB-128MB 64K-256K 5, 2 1, 2 340MB-545MB 4MB EISA card Q, 6, 0 2, 0, 0 1, 2, 0 VL-Bus card Weitek ■ ■ ■ □ 3 years parts, lifetime labor Included (1 year)	Data Storage Marketing Inc. DataStar EISA VL \$3,045 Intel 486DX/66 only ■ ■ ■ Desktop EISA 230W (5) ECS SIS AMI (11/11/92) □ 1MB-128MB 64K-256K 3, 2 None 130MB-2GB None VL-Bus card Q, 6, 0 2, 0, 0 1, 2, 0 VL-Bus card S3 ■ ■ ■ □ 3 years Included (1 year)	Data Storage Marketing Inc. DataStar ISA VL \$2,395-\$2,945 Intel 486SX/25- 486DX/66 ■ ■ ■ Desktop ISA 230W (5) ECS UMC AMI (11/11/92) □ 1MB-32MB 128K-256K 3, 2 None 130MB-2GB 2MB VL-Bus card Q, 6, 0 2, 0, 0 1, 2, 0 VL-Bus card S3 ■ ■ ■ □ 3 years Included (1 year)	Dell Computer Corp. Dell Dimension XP5 \$3,546-\$3,646 Intel 486DX/66- 486DX/66 □ ■ ■ Desktop ISA 200W (5) Dell Micronics Phoenix (1/15/88) □ 4MB-64MB 128K-256K 3, 0 0, 2 230MB-450MB None Motherboard Q, 7, 0 2, 0, 0 1, 2, 1 VL-Bus card S3 ■ ■ ■ ■ 1 year Included (1 year)	Dell Computer Corp. Dell OptiPlex MKV \$3,498-\$3,898 Intel 486DX/33- 486DX/66 □ ■ ■ Small-footprint ISA 140W (3) Dell Headland Phoenix (7/13/93) □ 4MB-64MB 128K 3, 0 None 80MB-1GB None Motherboard Q, 5, 0 2, 0, 0 1, 2, 1 VL-Bus card Tang ■ ■ ■ □ 1 year Included (1 year)	Destiny Computers Destiny Blitz 486SLC/2 \$2,250-\$2,600 IBM 486SLC/50- 486SLC/80 ■ ■ ■ Desktop ISA 110W (4) IBM OPTi AMI (6/6/93) □ 1MB-16MB None Motherboard Q, 6, 0 None 1, 2, 0 ISA card WD □ □ □ □ 1 year N/A	Diamond Technologies Inc. Diamond DT 486DX Versa \$2,915-\$3,155 AMD Am486DX/40- Intel 486DX/66 □ ■ ■ Tower EISA 250W (4) SIC Mint AMI 1.3 □ 4MB-128MB 64K-1MB 5, 0 5, 0 113MB-1GB 4MB VL-Bus card Q, 5, 3 2, 0, 0 1, 2, 0 VL-Bus card Weitek ■ ■ ■ □ 15 months parts, 2 years labor \$75 (1 year)	Digital Equipment Corp. DECpc LPv \$2,715-\$3,463 Intel 486SX/33- 486DX/66 ■ ■ ■ Small-footprint ISA 146W (4) Digital SIS Phoenix 1.03 □ 4MB-64MB 256K 1, 1 2, 0 170MB-1GB None Motherboard Q, 3, 0 None 1, 2, 1 Motherboard S3 ■ ■ ■ ■ 3 years Included (1 year)	Digital Equipment Corp. DECpc LPx \$2,963-\$3,603 Intel 486SX/33- 486DX/66 ■ ■ ■ Small-footprint ISA 215W (5) Digital SIS Phoenix 1.03 □ 4MB-64MB 256K 3, 1 0, 1 170MB-1GB None Motherboard Q, 4, 0 2, 0, 0 1, 2, 1 VL-Bus card S3 ■ ■ ■ ■ 3 years Included (1 year)

accelerator secured the models' great DOS video numbers and respectable Graphics WinMark scores. The models' hard disk numbers were below average under both DOS and Windows, while

HiQ Ultra- Graphics Station

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	FAIR
Expandability	GOOD
Overall value	EXCELLENT

Winstone and DOSmark scores were average. You can buy a HiQ unit in a standard desktop or medium-tower case. The desktop unit has two fewer internal drive bays, and memory is harder to reach. With each model, you'll find ADI Systems' MicroScan 3G—a good monitor. Units carry upgradable motherboards with processor LIF (light-insertion-force) sockets and removable oscillators.

HiQ systems carry one-year parts, two-year labor warranties. On-site service is unavailable.—OR

• **HiQ Systems Inc., 740 North Mary Ave., Sunnyvale, CA 94086; 800-827-5836.**

Circle 458 on reader service card

Hi-Tech USA

Hi-Tech Super EISA/VLB

Hi-Tech USA is aiming at those buyers who are interested solely in screaming Windows graphics speed, even at the expense of a well-rounded system.

With a competitive price tag for a local-bus EISA system, the Hi-Tech Super EISA/VLB machines are exceptional performers in most respects, including a top-notch Windows video subsystem. That last feature consists of the Diamond Viper card, using the Weitek P9000 chip and 2MB of VRAM, and the award-winning 15-inch Nanao F340i-W monitor. Using a high-quality CRT, the Nanao displays crystal-clear images and is adjustable via front-mounted controls with both factory- and user-definable settings.

The rest of the system is easily manageable inside a roomy, medium-sized tower case. You've got plenty of empty EISA expansion slots, easily accessible

upgradable memory (though with a maximum of 256MB), and a CPU upgrade socket.

Windows performance for the 486DX2/50 (\$3,775) and the DX2/66 (\$3,895) systems was good. Processor, Graphics WinMark, and



WinStone scores for the 66-MHz PC were each among the top five overall. The DX2/50 system was no slouch either, setting the pace within its 13-member group. However, both disappointed in terms of DOS-based video and disk scores, falling well short of the mark.

A two-year parts and one-year labor warranty covers the Super EISA/VLB, but no on-site service is available.—OR

• **Hi-Tech USA, 1562 Centre Pointe Dr., Milpitas, CA 95035; 800-831-2888.**

Circle 485 on reader service card

Hi-Tech Super EISA/VLB

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	EXCELLENT

SUMMARY OF FEATURES

Products listed in alphabetical order by company

■ = YES □ = NO

	Digital Equipment Corp. DECpc MTE	Digital Equipment Corp. DECpc ST	Duracom Computer Systems DeskSaver 486 EISA	Duracom Computer Systems DeskSaver 486 VESA	Dyna Micro Inc. VL Business Systems	Etech Research Inc. Etech Splendor	Epson America Inc. Epson Progression 4	Epson Direct Epson Endeavor WS
Price range	\$5,415-\$5,818	\$4,943-\$7,258	\$2,949-\$3,399	\$2,599-\$3,049	\$2,495-\$2,950	\$2,399-\$2,649	\$2,537-\$3,239	\$2,745-\$3,165
Range of processors available	Intel 486DX/33-486DX2/66	Intel 486DX/33-Pentium/80	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	IBM 486SLC2/50-486SLC2/66	Intel 486SX/33-486DX2/66	Intel 486SX/33-486DX2/66
Dealers/Direct-distribution channel	■ ■	■ ■	■ □	■ □	■ ■	■ □	■ □	■ ■
Case style	Mini-tower	Tower	Small-footprint	Small-footprint	Small-footprint	Mini-tower	Small-footprint	Small-footprint
Bus architecture	EISA	EISA	EISA	ISA	ISA	ISA	ISA	ISA
Power supply (and number of connectors)	420W (6)	254W (6)	200W (5)	200W (5)	205W (5)	220W (8)	145W (4)	145W (4)
Motherboard manufacturer	Digital	Digital	Duracom	Duracom	Asus, Addonics	Alaris	Epson	Epson
Chip set manufacturer	SIS	Intel	Ti	Coritac	SIS	OPTi	C&T, Epson	UMC
BIOS version (or date)	Phoenix 1.02	Phoenix (8/25/92)	AMI (12/12/91)	AMI (11/11/92)	AMI (11/11/92)	AMI (6/6/92)	Epson (3/24/93)	Epson (3/24/93)
Flash memory	■	■	□	■	■	■	■	■
Installable RAM on motherboard	1MB-128MB	1MB-128MB	1MB-128MB	1MB-32MB	4MB-32MB	1MB-16MB	4MB-36MB	4MB-36MB
Installable external RAM cache	256K	256K	64K-256K	64K-256K	64K-256K	64K-128K	None	None
Accessible drive bays (5.25", 3.5")	3, 1	3, 1	3, 1	3, 1	2, 2	2, 1	2, 0	2, 0
Internal drive bays (5.25", 3.5")	0, 1	0, 1	0, 2	0, 2	None	1, 1	0, 1	0, 1
Hard disk options	170MB-1GB	170MB-1GB	130MB-1.4GB	83MB-1.4GB	170MB-1GB	170MB-1GB	120MB-340MB	120MB-340MB
Disk controller cache	None	None	4MB	4MB	4MB	None	None	None
Disk controller location	Motherboard	Motherboard	EISA card	VL-Bus card	VL-Bus card	VL-Bus card	Motherboard	Motherboard
8-bit, 16-bit, 32-bit slots	0, 0, 5	0, 0, 0	0, 0, 0	2, 0, 0	0, 4, 2	1, 7, 0	0, 4, 0	0, 4, 0
VESA, PCI, proprietary slots	1, 0, 1	0, 0, 2	1, 0, 1	2, 0, 0	2, 0, 0	2, 0, 0	None	None
Parallel, serial, mouse ports	1, 2, 1	1, 2, 3	1, 2, 0	1, 2, 0	2, 2, 0	1, 2, 0	1, 2, 1	1, 2, 1
Display circuitry location	VL-Bus card	ISA card	VL-Bus card	VL-Bus card	ISA card	Motherboard LB	Motherboard	Motherboard LB
Video chip set manufacturer	Waitak	S3	ATI	ATI	Cirrus Logic	Cirrus Logic	C&T	C&T
DOS 6.0/Windows 3.1/Other software included	■ ■ ■	■ ■ ■	■ ■ □	■ ■ □	■ ■ □	■ ■ □	■ ■ □	■ ■ □
Warranty	3 years	3 years	1 year	1 year	1 year	1 year	1 year	1 year
On-site service charge	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	\$48 (1 year)	\$69 (1 year)	Included (1 year)	Included (1 year)

Ambra Computer Corp.

Ambra Desktop

Located in Raleigh, NC, Ambra Computer Corp. is a wholly owned subsidiary of IBM Corp. that has an independent take on how to sell directly in today's PC business. The products of this newcomer compete seriously with the established direct marketers on price and features.

The \$2,619 486DX2/66 Ambra we received carried the full requested configuration as well as on-board Ethernet connectivity, and a 15-inch MPR-II-compliant monitor. Ambra sells desktop, mini-tower, and tower versions containing everything from Blue Lightning processors to EISA configurations running dual-Pentium processors. Not all of these products are available at this point, however.

System documentation covers all of the bases with manuals aimed at both the beginner and the advanced user. If you order an Ambra with a CD-ROM drive,



you will also receive a free disk that contains over 80 popular software titles. You can use the programs three times for free, then a fee is required.

Performance was competitive, especially considering the unit's price. The Ambra Desktop's processor score was slightly below average, but its DOS disk score and especially its video score more than made up for this shortcoming. The Ambra's other scores were solidly in the mainstream.

Ambra Computer Corp. offers a one-year parts-and-labor warranty (compared with three years for many IBM lines)

with free on-site service.—OR

• **Ambra Computer Corp., 3200 Beechleaf Court, Raleigh, NC 27604; 800-252-6272.**

Circle 487 on reader service card

Ambra Desktop

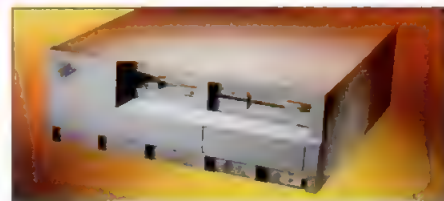
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	EXCELLENT

IBM Personal Computer Co.

IBM ValuePoint

IBM's consumer-friendly way of doing business is apparent with its recently revamped ValuePoint line. This line is a giant step in the right direction, comprising low-cost, high-performance computers aimed at mainstream businesses.

The ValuePoint isn't the only low-cost corporate horse in IBM's stable. Big Blue's new Ambra line is also value-



priced and aimed at mainstream businesses. Additionally, IBM's PS/1 and PS/2 lines are being redesigned.

ValuePoint systems arrived in two standard desktop cases, one containing a 486DX/33 (\$3,419), the other holding a 486DX2/66 (\$3,769). Inside each model's five-bay case, you've got the makings of a technologically up-to-date PC: an ISA

Everex Systems Inc. Everex Step VL EISA	First Computer Systems Inc. FCS President PAK VL8	FutureTech Systems Inc. FutureTech System 40XeV	Gateway 2000 VESA Local- Bus Line	Golden Star Technology GST 486V	Hewlett-Packard Co. HP Vectra XM	HiQ Systems Inc. HiQ Ultra- Graphics Station	Hi-Tech USA Hi-Tech Super EISA/VLB	IBM Personal Computer Co. IBM ValuePoint	Insight Insight EcoSystem
\$3,909-\$4,231	\$2,699-\$2,999	\$2,969-\$3,379	\$2,435-\$2,995	\$2,599-\$2,899	\$3,584-\$4,154	\$2,519-\$2,739	\$3,715-\$3,895	\$3,069-\$3,769	\$2,999-\$3,499
Intel 486DX/33-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/33-486DX2/66
Desktop	Tower	Tower	Tower	Small-footprint	Desktop	Tower	Mini-tower	Desktop	Desktop
EISA	EISA	EISA	ISA	ISA	ISA	EISA	EISA	ISA	ISA
200W (3)	250W (6)	250W (5)	200W (6)	250W (6)	100W (4)	250W (5)	250W (4)	200W (5)	145W (4)
MCCI	MCCI	Mars Technology	Micronics	Micronics	HP	Joint	MCCI	Intel	Intel
SIS	Hint	Hint	Micronics	Micronics	VLSI	Hint	SIS	Intel	VLSI
AMI (7/1/83)	AMI (2/17/83)	AMI (1/15/83)	Phoenix (1/15/88)	Phoenix (1/15/88)	Phoenix 4.0	AMI (7/7/91)	AMI (6/6/92)	AMI 1.04	Phoenix (5/24/83)
4MB-64MB	1MB-128MB	1MB-128MB	1MB-64MB	1MB-64MB	1MB-64MB	1MB-128MB	1MB-256MB	1MB-64MB	2MB-32MB
256K-1MB	64K-1MB	64K-256K	64K-256K	Up to 256K	Up to 256K	64K-256K	256K-1MB	Up to 256K	64K-256K
3, 0	6, 0	4, 0	4, 0	2, 2	1, 1	3, 2	3, 1	2, 0	2, 1
1, 1	None	2, 0	0, 5	1, 0	2, 0	0, 1	None	3, 0	0, 1
0-525MB	340MB-1GB	340MB-2GB	80MB-1GB	245MB-1.5GB	170MB-1GB	120MB-1.2GB	340MB	128MB-527MB	80MB-340MB
2MB	1MB	4MB	None	None	None	4MB	4MB	None	None
EISA card	VL-Bus card	VL-Bus card	Motherboard	VL-Bus card	Motherboard	VL-Bus card	EISA card	Motherboard	Motherboard
0, 0, 7	0, 5, 3	0, 5, 3	0, 7, 0	0, 5, 0	0, 4, 0	0, 5, 3	0, 0, 7	0, 4, 0	0, 3, 0
1, 0, 0	2, 0, 0	2, 0, 0	2, 0, 0	2, 0, 0	None	2, 0, 0	1, 0, 0	1, 0, 0	None
1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0	1, 1, 1	2, 2, 0	2, 4, 0	1, 2, 1	1, 2, 1
VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	Motherboard	VL-Bus card	VL-Bus card	Motherboard	Motherboard
Waittek	Waittek	Orchid	ATI	S3	S3	Cirrus Logic	Waittek	S3	Cirrus Logic
1 year	2 years parts, lifetime labor	15 months	1 year	1 year	3 years	1 year parts, 2 years labor	1 year parts, 2 years labor	1 year	1 year
Included (1 year)	\$50 (1 year)	\$58 (1 year)	Included (1 year)	N/A	Included (1 year)	N/A	N/A	Included (1 year)	N/A

bus with VL-Bus support, an easy-to-use ZIF processor socket, and integrated local-bus-video and hard disk-controller circuitry. The systems have VESA-com-

► IBM ValuePoint

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	GOOD

renewed strength at IBM.

Performance was no disappointment either. No score dipped below average, and the DX2/66 even turned in some top scores on our DOS video, DOS disk, and Graphics WinMark tests. The DX/33 couldn't match this pace but maintained respectable results in its CPU class.

IBM's one-year warranty includes a year of on-site service. IBM's service remains among the best deals in the business.—OR

• **IBM Personal Computer Co., Rte. 100, Somers, NY 10589; 800-772-2227.**
Circle 486 on reader service card

Insight Insight EcoSystem

As one of the first vendors to respond to the Environmental Protection Agency's Energy Star program encouraging manufacturers to build power-managed PCs, Insight has come out with the EcoSystem line. These systems are aimed at main-

Insight EcoSystem	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

floppy/hard disk-controller, and video circuitry. System memory is currently limited to 32MB but will increase with the advent of larger-capacity SIMMs. The on-board Cirrus Logic video chip and Super I/O IDE controller chip are run through an integrated local bus.

As far as power conservation goes, the



15-inch Nanao Flexscan F340i-W monitor certainly does its part. This display does credit to Nanao USA Corp.'s usual reputation for crisp,

clear picture quality but is also MPR-II compliant, with a low-power microprocessor and an internal sleep mode.

Performance was favorable, with the models posting above-average DOS video numbers: Their DOS disk and Graphics WinMark scores could have been better for this kind of money, but these marks certainly weren't lethargic.

Insight offers its usual one-year parts-and-labor warranty but does not offer on-site service.—OR

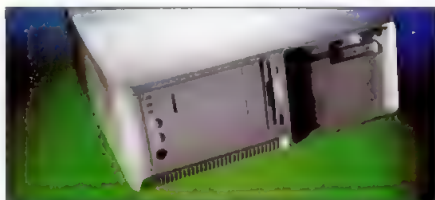
• **Insight, 1912 W. 4th St., Tempe, AZ 85281; 800-927-7848.**
Circle 488 on reader service card

SUMMARY OF FEATURES

Products listed in alphabetical order by company	Insight	Insight	International Instrumentation Inc.	Mega Computer Systems	Micro Express	Micron Computer Inc.	Micron Computer Inc.	Micron Computer Inc.
	Insight VL	Insight VL/EISA	Int. Instr. Blue Max Monolith	Mega Eco Series	MicroFLEX-VL	Micron 486VL MagServer	Micron 486VL WindServer	Micron 486VL WinStation
Price range	\$2,299–\$2,699	\$3,399–\$3,699	\$2,197–\$2,597	\$2,177–\$2,606	\$2,299–\$2,699	\$3,599–\$3,799	\$3,599–\$3,799	\$2,499–\$2,799
Range of processors available	Intel 486SX/33–486DX2/66	Intel 488DX/33–486DX2/66	Intel 486SX/25–486DX2/66	Intel 486SX/25–486DX2/66	Cyrix 486S/40–Intel 486DX2/66	Intel 488DX/33–486DX2/66	Intel 488DX/33–486DX2/66	Intel 486SX/33–486DX2/66
Dealers/Direct-distribution channel	☐ ■	☐ ■	■ ■	■ ■	☐ ■	■ ■	■ ■	■ ■
Case style	Desktop	Tower	Tower	Slimline	Mini-tower, ISA	Tower	Tower	Small-footprint, ISA
Bus architecture	ISA	EISA	ISA	ISA	ISA	EISA	EISA	ISA
Power supply (and number of connectors)	230W (4)	250W (8)	254W (5)	145W (3)	200W (7)	250W (7)	250W (8)	200W (5)
Motherboard manufacturer	Asus	Asus	Int. Instr.	Intel	Micro Express	Micronics	Micronics	Micronics
Chip set manufacturer	SIS	SIS	SIS	VLSI	Farax	Micronics	Micronics	Micronics
BIOS version (or date)	AMI (11/11/92)	Award (4/30/92)	AMI (8/6/92)	Phoenix (3/22/93)	AMI (11/11/92)	Phoenix 1.01.29-2	Phoenix (2/6/93)	Phoenix 1.01
Flash memory	☐	■	☐	■	☐	■	■	■
Installable RAM on motherboard	256K–32MB	1MB–128MB	1MB–32MB	4MB–32MB	4MB–32MB	4MB–64MB	4MB–64MB	Up to 256K
Installable external RAM cache	128K–256K	64K–256K	128K–1MB	64K–256K	Up to 256K	Up to 256K	Up to 256K	4MB–64MB
Accessible drive bays (5.25", 3.5")	3, 2	2, 1	3, 1	2, 1	3, 0	6, 0	6, 0	3, 0
Internal drive bays (5.25", 3.5")	None	0, 1	1, 0	0, 1	0, 2	1, 0	0, 2	0, 1
Hard disk options	80MB–2.9GB	210MB–2.9GB	43MB–2.4GB	170MB–1.2GB	700MB–2.4GB	245MB–1.2GB	245MB–1.2GB	245MB–1.2GB
Disk controller cache	None	4MB	4MB	None	512KB	32K	32K	None
Disk controller location	VL-Bus card	EISA card	VL-Bus card	Motherboard	VL-Bus card	VL-Bus card	VL-Bus card	Motherboard
8-bit, 16-bit, 32-bit slots	0, 7, 2	0, 0, 7	2, 4, 2	0, 3, 0	1, 6, 0	0, 0, 8	0, 0, 8	0, 8, 0
VESA, PCI, proprietary slots	2, 0, 0	1, 0, 0	2, 0, 0	None	2, 0, 0	2, 0, 0	2, 0, 0	2, 0, 0
Parallel, serial, mouse ports	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0
Display circuitry location	VL-Bus card	VL-Bus card	VL-Bus card	Motherboard LB	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card
Video chip set manufacturer	Cirrus Logic	Cirrus Logic	Cirrus Logic	Cirrus Logic	Weitek	Cirrus Logic	Weitek	Weitek
DOS 6.0/Windows 3.1/Other software included	■ ■ ☐	■ ■ ☐	■ ■ ■	■ ■ ■	■ ■ ☐	■ ■ ■	■ ■ ■	■ ■ ■
Warranty	1 year	1 year	1 year	1 year	2 years	1 year	1 year	1 year
On-site service charge	N/A	N/A	Included (1 year)	\$350 (1 year)	\$50 (1 year)	N/A	N/A	N/A

Insight Insight VL

The Insight VL line is a thoroughly competitive family of computers offered at very sweet prices. The line's lack of on-site service is balanced by excellent components and adequate performance across the range of benchmark tests.



Using a combination of the ISA and VL-Bus architectures, these units are offered at prices that range from \$2,299 (for models with 486SX/33 microprocessors) to \$2,699 (for models that come equipped with 486DX2/66 microprocessors)—prices that easily undercut the majority of the field by at least \$400.

The company doesn't skimp on components either. With all of the tested models, both video and hard disk circuitry are run off the VESA local bus, and systems have been constructed using quality brand-name components—most notably the award-winning 15-inch MAG MX15F monitor. Video is by way of a Cirrus Logic VL-Bus card. The VL line may not have fancy frills, but it delivers what midrange buyers want at prices they demand.

The performance of these models didn't quite rival the price point for aggressiveness, but the test scores they produced certainly held their own. The DOS video scores of the Insight VL's were especially competitive. All of the other test results stayed safely in the middle of the pack.

The standard warranty that Insight provides with its systems runs for one year on parts and labor. On-site service is not available.—OR

• **Insight, 1912 W. 4th St., Tempe, AZ 85281; 800-927-7848.**
Circle 488 on reader service card

Insight Insight VL/EISA

Intended as crossover high-end systems that can do duty as file servers, Insight VL/EISA units pack some powerful performance punches at prices that are mid-range or better for comparable hardware.

Your first sign of an Insight VL/EISA unit's file server aspirations is its large-tower case that contains room for six external drive devices and one internal device. The EISA bus dominates, but video is run off the VESA local bus. Our only caveat here was the 8-bit I/O card that was installed; these ports should be run off the motherboard in systems as powerful as these. To its products' advantage, the company chose to use a cached EISA SCSI hard disk controller.



MS Engineering Inc. MSE486	National MicroComputers NMC Universal Power-System	National MicroComputers NMC Universal Pro-System	NCR Corp. Local-Bus Work- station (Desktop)	NCR Corp. Local-Bus Work- station (Tower)	NEC Technologies Inc. NEC Image 486 Series	Pactron Integration Computer Inc. Pactron PowerPAC	Personal Computer Graphics Corp. PCG Turbo Burst	Polywell Computers Inc. Poly 486EV	Quill Corp. QTech Computers VL Series
\$2,550-\$2,750	\$4,811-\$5,045	\$2,290-\$2,740	\$3,080-\$3,830	\$3,535-\$4,265	\$3,382-\$4,167	\$2,250-\$2,550	\$2,772-\$3,547	\$2,750-\$3,150	\$2,299-\$2,699
Intel 486DX/33- 486DX2/66	Intel 486DX/33- 486DX2/66	Intel 486SX/25- 486DX2/66	Intel 486SX/25- 486DX2/66	Intel 486SX/25- 486DX2/66	Intel 486SX/25- 486DX2/66	Intel 486SX/25- 486DX2/66	Intel 486DX/33- Pentium	Intel 486SX/33- 486DX2/66	Intel 486SX/25- 486DX2/66
Mini-tower	Desktop	Small-footprint	Small-footprint	Mini-tower	Desktop	Small-footprint	Tower	Tower	Small-footprint
ISA	EISA	ISA	ISA	ISA	ISA	ISA	ISA	EISA	ISA
200W (8)	200W (8)	200W (8)	145W (4)	200W (8)	105W (3)	200W (4)	250W (4)	230W (5)	200W (5)
Micronics	ECS	ECS	NCR	NCR	NEC	MCCI	YMS	AJR	TMC
Micronics	033	UMC	UMC	UMC	C&T	Hint	Symphony	SIS	OPTi
Phoenix 1.03M1.07	AMI (12/12/91)	AMI (11/11/92)	NCR 2.01	NCR 603.00	Phoenix 1.00.36	AMI (9/9/92)	AMI (11/11/92)	AMI (6/8/92)	AMI (6/8/92)
4MB-64MB	1MB-132MB	1MB-32MB	4MB-32MB	4MB-64MB	4MB-64MB	1MB-128MB	4MB-128MB	4MB-256MB	1MB-32MB
64K-256K	64K-256K	64K-256K	64K-256K	64K-256K	256K	256K-1MB	64K-1MB	64K-512K	64K-256K
3, 2	3, 0	3, 0	1, 1	2, 1	2, 0	3, 2	4, 0	3, 2	3, 2
0, 3	0, 2	0, 2	0, 1	0, 2	2, 0	0, 1	2, 0	0, 2	None
212MB-340MB	345MB-1.24GB	245MB-1.24GB	80MB-520MB	80MB-1.05GB	170MB-340MB	245MB-1GB	131MB-1.2GB	170MB-3.5GB	42MB-1.2GB
512K	16MB	4MB	None	None	64K	1MB	2MB	64K	None
VL-Bus card	EISA card	VL-Bus card	Motherboard	Motherboard	Motherboard	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card
0, 6, 0	0, 0, 8	0, 8, 0	0, 3, 0	0, 6, 0	0, 4, 0	0, 5, 1	0, 5, 0	0, 0, 5	0, 7, 0
2, 0, 0	2, 0, 0	2, 0, 0	None	2, 0, 0	None	2, 0, 0	3, 0, 0	3, 0, 0	2, 0, 0
1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 0	2, 2, 0	2, 2, 0	1, 2, 0
VL-Bus card	VL-Bus card	VL-Bus card	Motherboard	VL-Bus card	Motherboard	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card
Weitek	S3	S3	Cirrus Logic	Cirrus Logic	Tseng	S3	Weitek	Weitek	Weitek
1 year	1 year parts, 2 years labor	1 year parts, 2 years labor	3 years	3 years	3 years	1 year	5 years parts, 1 year labor	2 years parts, 5 years labor	1 year
N/A	\$39 (1 year)	\$39 (1 year)	Included (3 years)	Included (3 years)	Included (1 year)	3% of price (1 year)	Included (1 year)	\$75 (1 year)	Included (1 year)

Performance results speak for themselves. Under both DOS and Windows, the \$3,399 486DX/33 and \$3,699 486DX2/66 systems delivered some of

► Insight VL/EISA

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	EXCELLENT

the highest disk throughput numbers that we saw in this roundup. The DX2/66 placed fourth overall on our DOS disk tests.

Insight VL/EISA systems' DOS video marks were outstanding as well, and none of their other scores dipped below average. The DX/66 posted particularly impressive DOSmark and Winstone scores, ranking sixth and thirteenth overall, respectively.

Insight offers a seven-day-a-week, 24-hour toll-free technical-support line and includes a one-year parts-and-labor warranty with each system. The company does not provide on-site service, however.—OR

• **Insight, 1912 W. 4th St., Tempe, AZ 85281; 800-927-7848.**

Circle 488 on reader service card

International Instrumentation Inc.

Blue Max Monolith

International Instrumentation's Blue Max Monolith line may not head anyone's performance charts, but its members managed solid test scores and are available at exceptionally low prices.

Each Blue Max unit's medium-tower case offers users plenty of expansion space with which to enhance and custom-



ize their PC investment. Also, the Blue Max line is one of the least expensive, with prices starting at \$2,197 for the 486SX/25 and extending only up to \$2,597 for the 486DX2/66.

A few caveats include the minifan mounted on the processor's heat sink, which interferes with full-length cards in three expansion slots. Also, we would have liked to have seen a ZIF processor socket as standard equip-

ment (not as an extra-cost option) and a more impressive display than the picture quality of the Samsung monitor.

Performance, however, was rock-solid

for both the SX/25 and DX2/66. Their VL-Bus Promise Technology IDE controllers with 345MB Maxtor hard disk drives pushed their DOS disk scores into the top levels of their respec-

tive CPU groups. This showing was undoubtedly helped by their 4MB of hardware cache. Their Genoa WindowsVGA 24 VL-Bus adapters carrying Cirrus Logic chip sets helped their DOS video scores excel but couldn't do quite as much for their Graphics WinMark scores, which were average.

A one-year parts-and-labor warranty and on-site service are included.—OR

• **International Instrumentation Inc., 2282 Townsgate Rd., Westlake Village, CA 91361; 800-543-3475.**

Circle 489 on reader service card

SUMMARY OF FEATURES

Products listed in alphabetical order by company

■ = YES □ = NO

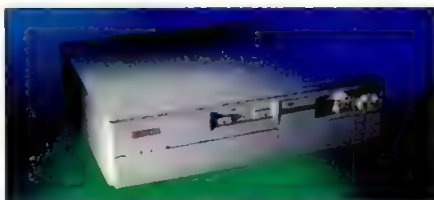
	Reason Technology Reason Square 4 LXPWA 486	Reason Technology Reason Square 4 LXPWS 486	Swan Technologies Inc. Swan 486 Direct Bus	Sys Technology Sys Juno Tower EISA/VEGA	Sys Technology Sys Medium Desktop-VEGA	Tangent Computer Inc. Tangent Black Box Pro Series	Tangent Computer Inc. Tangent VL	TC Computers TC VESA Video Pack
Price range	\$2,595-\$2,795	\$2,895-\$3,095	\$2,847-\$3,487	\$2,686-\$3,199	\$2,406-\$2,879	\$3,125-\$3,590	\$2,225-\$2,750	\$2,599-\$3,149
Range of processors available	Intel 486DX/33-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66
Dealers/Direct-distribution channel	■ ■	■ ■	□ ■	■ ■	■ ■	□ ■	□ ■	□ ■
Case style	Desktop	Desktop	Small-footprint	Tower	Small-footprint	Tower	Small-footprint	Desktop
Bus architecture	ISA	ISA	ISA	EISA	ISA	EISA	ISA	ISA
Power supply (and number of connectors)	200W (6)	200W (6)	200W (5)	250W (8)	230W (6)	230W (3)	200W (4)	200W (4)
Motherboard manufacturer	Reason	Reason	Swan	Giga-Byte	Giga-Byte	MCCI	Tyan	EFA
Chip set manufacturer	UMC	UMC	OPTI	SIS	UMC	Hint	SIS	UMC
BIOS version (or date)	AMI (3/25/93)	AMI (3/25/93)	AMI (6/6/92)	AMI (6/6/92)	AMI (11/11/92)	AMI (7/7/91)	AMI (11/11/92)	AMI (6/6/93)
Flash memory	□	□	□	□	□	□	□	□
Installable RAM on motherboard	4MB-32MB	4MB-32MB	1MB-64MB	1MB-128MB	1MB-32MB	4MB-128MB	4MB-32MB	1MB-32MB
Installable external RAM cache	128K-256K	128K-256K	64K-256K	12K-512K	12K-256K	256K-1MB	64K-256K	64K-256K
Accessible drive bays (5.25", 3.5")	3, 0	3, 0	3, 2	8, 0	3, 2	3, 0	3, 0	3, 2
Internal drive bays (5.25", 3.5")	0, 2	0, 2	0, 2	1, 0	None	0, 2	0, 3	0, 1
Hard disk options	540MB	540MB-1.2GB	80MB-1GB	245MB-1GB	245MB-1GB	240MB-1GB	170MB-510MB	200MB-1.5GB
Disk controller cache	None	None	256K	64K	64K	2MB	None	2MB
Disk controller location	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	EISA card	VL-Bus card	VL-Bus card
8-bit, 16-bit, 32-bit slots	0, 6, 0	0, 6, 0	0, 7, 0	0, 0, 0	1, 3, 0	0, 5, 1	2, 5, 0	0, 6, 0
VESA, PCI, proprietary slots	2, 0, 0	2, 0, 0	2, 0, 0	2, 0, 0	3, 0, 0	2, 0, 0	2, 0, 0	2, 0, 0
Parallel, serial, mouse ports	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0
Display circuitry location	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card
Video chip set manufacturer	Weitek	Weitek	Weitek	Tseng	Tseng	ITT	Tseng	S3
DOS 6.0/Windows 3.1/Other software included	■ ■ ■	■ ■ ■	■ ■ □	■ ■ □	■ ■ □	■ ■ □	■ ■ □	■ ■ ■
Warranty	2 years	2 years	2 years	1 year parts, lifetime labor	1 year parts, lifetime labor	1 year	1 year	2 years parts, lifetime labor
On-site service charge	\$50 (1 year)	\$50 (1 year)	Included (2 years)	N/A	N/A	Included (1 year)	Included (1 year)	N/A

Mega Computer Systems

Mega Eco Series

The Mega Eco Series is an exercise in kinder and gentler computing. Designed to meet the Environmental Protection Agency's low-power Energy Star requirements, it also offers adequate performance at low prices.

These slimline units contain the latest in compact and fully integrated motherboard technology, including on-board-I/O, local-bus-video, and IDE floppy/hard disk-controller circuitry. Memory is limited to only 32MB.



Though scores were somewhat lackluster, keep in mind that this line's target audience is solidly mainstream. A

486SX/25-based unit sells for only \$2,177, while a 486DX2/66 climbs to only \$2,606.

The included monitor and documentation were the only substandard components. The monitor's picture quality left something to be desired, and its twist-knob controls were inconveniently rear-mounted. Documentation consisted of scattered tech manuals that lacked coherence and failed to pay attention to the needs of the layperson.

Performance was dead average across the board, with only the SX/25's DOS video marks climbing into the above-average range. Processor scores actually fell slightly below average for the DX2/66 system, and the SX/25's Windows video scores fell a little low as well.

Mega Computer Systems' warranty policy includes a year of free parts and labor, but the first year of on-site service presently costs an astonishing \$350.—OR • Mega Computer Systems, 10840 Thornmint Rd., San Diego, CA 92127; 800-338-6628.

Circle 490 on reader service card

Micro Express

MicroFLEX-VL

Micro Express's midpriced MicroFLEX-VL line provides middle-of-the-road 486 performance and is available at competitive prices that range from \$2,299 to \$2,699.

While each model's mini-tower case provides enough room for five devices, it is a little cramped. Of the five free ISA



slots, for example, one 16-bit slot can accept only a half-length board because it has been partially blocked by the drive bay.

All the tested PCs in this line came equipped with a VL-Bus graphics accelerator based on a Weitek Power 9000 chip and a VL-Bus IDE disk controller with 512K of hardware cache. At the low-end, the Cx486S/40-based unit, which sells for \$2,299, produced pro-

TC Computers	Touche Micro Technologies	Tri-Star Computer Corp	Unisys Corp.	Unisys Corp.	Unitek Technology Inc.	Xinetron Inc.	Xinetron Inc.	ZEOS International Ltd
TC Workstation Powerhouse	Touche ISA VLB	Tri-CAO VL-Station	Unisys PW Advantage	Unisys PW Advantage Partner	Unitek LB System	Xinetron X/Lan 486	Xinetron X/Lan Station	ZEOS Upgradable
\$2,899-\$3,699	\$2,699-\$3,399	\$5,295-\$5,495	\$3,848-\$4,648	\$1,448-\$2,098	\$2,945-\$3,185	\$2,229-\$2,699	\$2,499-\$2,699	\$2,742-\$3,242
Intel 486SX/25-486DX2/66	Intel 486DX/33-Pentium 60	Intel 486DX/33-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486DX/33-486DX2/66	Intel 486SX/25-486DX2/66	Intel 486DX/3-486DX2/66	Intel 486SX/25-486DX2/66
□ ■	■ □	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Tower	Tower	Tower	Desktop	Slitline	Tower	Mini-tower	Small-footprint	Small-footprint
ISA	ISA	ISA	ISA	ISA	EISA	ISA	ISA	ISA
230W (5)	300W (5)	250W (5)	200W (5)	73W (2)	250W (6)	200W (4)	150W (4)	200W (8)
EFA	AMI	Area Electronics	Unisys	Unisys	Tyan	Xinetron	Xinetron	ZEOS
UMC	AMI	UMC	VIA	UMC	SIS	USA	SIS	VLSI
AMI (6/6/92)	AMI (11/11/92)	AMI (11/11/92)	Award 4.20	AMI (11/11/92)	AMI (4/6/93)	AMI (6/6/92)	AMI (11/11/92)	Phoenix Q3 07 0
□	□	□	□	□	□	□	□	■
1MB-32MB	4MB-64MB	4MB-32MB	4MB-64MB	1MB-64MB	4MB-256MB	1MB-64MB	1MB-64MB	2MB-64MB
64K-256K	64K-256K	64K-256K	256K	None	64K-1MB	64K-256K	64K-256K	Up to 256K
6.0	3.2	4.0	3.1	0.1	6.0	2.2	0.1	2.2
2.0	0.2	0.2	0.1	0.1	None	0.2	0.1	2.0
250MB-1.5GB	300MB-2.5GB	200MB-1GB	245MB-1.2GB	85MB-240MB	213MB-3.5GB	130MB-2.4GB	130MB-2.4GB	107MB-2GB
2MB	4MB	16MB	None	None	2MB	1MB	1MB	None
VL-Bus card	VL-Bus card	VL-Bus card	Motherboard	Motherboard	EISA card	VL-Bus card	VL-Bus card	Motherboard VL-Bus
2.4.0	0.5.0	1.3.0	0.4.0	0.2.0	0.0.6	1.5.0	0.5.0	1.5.0
2.0.0	2.0.0	3.0.0	2.0.0	0.0.1	2.0.0	2.0.0	2.0.0	2.0.0
1.2.0	1.2.0	1.2.0	1.2.1	1.2.1	1.2.0	1.2.0	1.2.0	1.2.0
VL-Bus card	VL-Bus card	VL-Bus card	Motherboard	Motherboard	VL-Bus card	VL-Bus card	VL-Bus card	VL-Bus card
Weitek	ITT	Weitek	S3	Cirrus Logic	S3	S3	Tseng	Weitek
■ ■ ■	■ ■	■ ■ □	■ ■ □	■ ■ □	■ ■ □	■ ■ ■	■ ■ ■	■ ■ ■
2 year parts, lifetime labor	2 years	2 years	1 year	1 year	1 year parts, lifetime labor	3 years	3 years	1 year
N/A	\$129 (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	Included (1 year)	\$45 (1 year)	\$45 (1 year)	\$49 (1 year)

cessor scores in line with those of a 486SX/33-based machine. Consequently, even the fast video card and cached hard disk controller couldn't pull this system out of the bottom 25 percent of machines under Windows.

► MicroFLEX-VL

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

The company's midrange 486DX/50 unit (\$2,649) was an average performer compared with the other four 486DX/50-based units, but it placed in the top 25 percent overall. Marks garnered by the top-the-line 486DX2/66 (\$2,699) equaled or exceeded the scores posted by the DX/50—except for its DOS video marks, which fell slightly short.

First-time PC owners may not appreciate Micro Express's minimalist documentation, but they can take some comfort in the company's two-year parts-and-labor warranty.—*John R. Quain*

• **Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9900.**
Circle 491 on reader service card

Micron Computer Inc.

Micron 486VL MagServer

Although they each use different versions of the same EISA motherboard and share the same tower case as the Micron 486VL WindServer units (and are priced in the same range), members of the Micron 486VL MagServer line have been configured as good all-around PCs that favor DOS performance.

Intended as workstation workhorses, the 486DX/33 (\$3,599) and 486DX2/66 (\$3,799) models we tested came with huge 1.2GB Maxtor SCSI drives with VL-Bus controllers and Diamond Computer SpeedSTAR Pro VL video adapters.

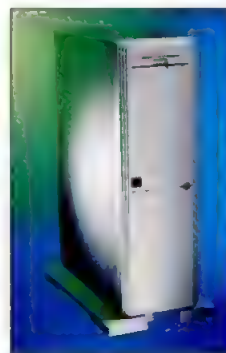
The DX/33 performed better than average on all of our DOS tests and ended up with a slightly above-average DOSmark score in its CPU category. The SCSI disk drive subsystem made a particularly good showing among the DX/33-based units in this roundup. Even though the Mag-

Servers did not demonstrate the graphics speed of their WindServer cousins under Windows, they can be viewed as adequate systems for working within the Windows environment.

The DX2/66 showed its DOS prowess with a DOSmark score

► 486VL MagServer

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	GOOD



that fell into the top ten of all the systems in this roundup. Again, the slower video adapter didn't help the model break any barriers on our Graphics WinMark tests, but the disk subsystem carried it through our Winstone test and helped it finish an impressive 14th overall.

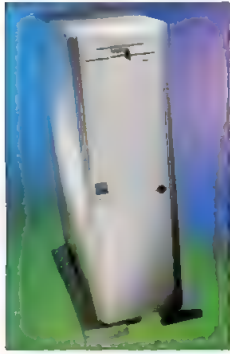
Micron Computers includes a one-year parts-and-labor warranty, but no on-site service is offered.—*JQ*

• **Micron Computer Inc., 915 E. Karcher Rd., Nampa, ID 83687; 800-438-3343.**
Circle 492 on reader service card

Micron Computer Inc.

Micron 486VL WinServer

To distinguish these models from those in its WinStation line, Micron Computer has endowed each member of its Micron



► 486VL WinServer

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	EXCELLENT

486VL WinServer line with a Micronics EISA system board equipped with two VL-Bus slots, a larger SCSI drive, and a tower case. The WinServers parallel units in Micron's MagServer line, but they have faster graphics accelerator cards and less hard disk capacities.

The two units we saw, a 486DX/33 and a 486DX2/66, each included six front-accessible 5.25-inch drive bays and a ZIF CPU upgrade socket. They each had only four SIMM sockets, however, and all were filled to reach 16MB, making system memory upgrades difficult.

Within its processor class, the \$3,599 DX/33 managed average Windows performance, which compared well to the Windows showing of the lower-priced, DX/33-equipped WinStation. But WinServers have larger and faster SCSI hard disks, and they posted better DOS scores than their WinStation counterparts.

The \$3,799 DX2/66 turned in a DOSmark score that landed in the top tier, but its DOS video score was rather poor. Its good Graphics WinMark score balanced things out, however. The Diamond Viper VL-Bus card secured an only marginally impressive Winstone test result for the DX2/66.

Micron covers these systems with one-year parts-and-labor warranties.—JQ

• **Micron Computer Inc.**, 915 E. Karcher Rd., Nampa, ID 83687; 800-438-3343.
Circle 492 on reader service card

Micron Computer Inc.

Micron 486VL WinStation

With systems priced from \$2,499 to \$2,799, the 486VL WinStation line is the entry point for Micron's three offerings. These desktop ISA systems provide less storage capacity and slightly lower performance than other Micron PCs.

Using a case that opens with one thumbscrew, each system has the CPU seated in a ZIF socket. Each unit's four SIMM sockets are filled to capacity at 16MB. Like the Micron WinServers, these models come with a Diamond Viper (Power 9000) VL-Bus graphics accelerator. The three models we tested—a 486SX/33 (\$2,499), 486DX/33 (\$2,599), and 486DX2/66 (\$2,799)—each came with a 340MB Maxtor IDE hard disk connected to a motherboard IDE controller.

Windows performance for all three systems was good within their CPU categories, and DOS disk and video scores, though below average, were buoyed by solid processor scores to secure average DOSmark scores.

The DX/33 did well in its CPU category on our Winstone test, while the DX2/66 just kept pace. The DX/33's DOSmark score, however, was considerably behind that of the other DX/33 machines.

Of the three Micron lines, the WinStations'



scores were in the middle—beneath the WinServers' and above the MagServers'.

Micron includes a one-year parts-and-labor warranty.—JQ

• **Micron Computer Inc.**, 915 E. Karcher Rd., Nampa, ID 83687; 800-438-3343.
Circle 492 on reader service card

MS Engineering Inc.

MSE486

MS Engineering takes a meat-and-potatoes approach to direct marketing of computers. The company's MSE486 family offers down-to-earth value and excellent Windows performance.

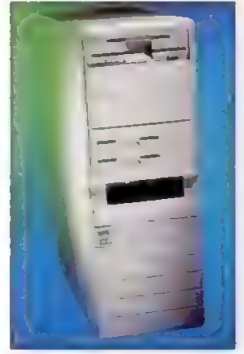
Based on a Micronics combination VL-Bus/ISA motherboard, each system's VL-Bus connectors are occupied by an Orchid Technology video board that uses a Weitek Power 9000 video controller and a Promise Technology VL-Bus controller with 512K of hardware cache.

The representative \$2,650 DX2/50 and \$2,750 DX2/66 MSE systems showed their forte to be Windows operation. Though DOSmark results for both systems were average—due to poor video scores—the DX2/66 system was in the top ten overall in Winstone testing.

Each system's mini-tower case comes with a dual floppy disk drive that leaves two accessible 5.25-inch drive bays open in front. Inside there's room for up to three 3.5-inch hard disks, in addition to the Western Digital 340 IDE drive. Of the six 16-bit ISA slots, an 8-bit I/O card takes up one ISA slot, leaving five slots free.

Fast, solid components are the attractions in the MSE486 line. MS Engineering includes the standard one-year parts-and-labor warranty with all of its MSE 486 systems.—JQ

• **MS Engineering Inc.**, 10601 South De Anza Blvd., #214 Cupertino, CA 95014; 408-257-4249.
Circle 493 on reader service card



► MSE486

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	FAIR

National MicroComputers

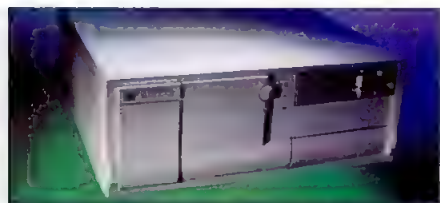
Universal Power-System

With superior performance and prices of around \$5,000, the National MicroComputers Universal Power-System models have been designed for high-end users.

Outfitted for those who deal with sophisticated graphics and have high storage demands, each Universal Power-System has eight 32-bit EISA expansion slots and two VL-Bus slots. Our test models—a 486DX/33 unit (\$4,811) and a 486DX2/66 system (\$5,045)—each came

equipped with a VL-Bus STB Pegasus GUI accelerator card that includes both VGA and BNC outputs. A cached SCSI controller that was fully loaded with 16MB of memory was installed in one EISA slot and wired to a Fujitsu 520MB SCSI hard disk.

On our tests, the DX/33 model achieved about average Windows scores compared with other DX/33 units. Its cached disk subsystem rose above the



rest, and helped the unit post DOS disk test scores that were 30 percent above average in the model's CPU group. Extremely good DOS disk performance highlighted the DX2/66's test results as well. Unfortunately, the DX2/66 turned in only average DOSmark and Winstone scores.

NMC includes a one-year parts, two-years labor warranty and charges \$39 for one year of on-site coverage.—JQ

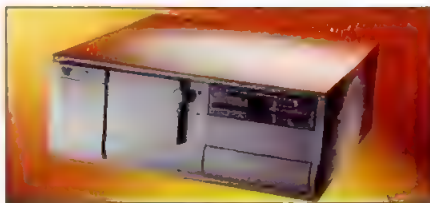
• **National MicroComputers**, 3855 South 500, West Salt Lake City, UT 84115; 800-424-2983.

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National MicroComputers

Universal Pro-System

The ISA-based National MicroComputers Universal Pro-System models are a step below NMC's high-end Universal Power-System units. With mainstream prices, these models are suited to the general user.



These models come in the same no-tools-needed desktop cases used for the Universal Power-System units. The units we tested—a 486DX/33 (\$2,460) and (\$2,740) 486DX2/66—each had five open ISA slots and two VL-Bus slots. One VL-Bus slot contained a cached IDE hard disk controller; the other held an Actix GraphicsEngine 32 VL plus GUI accelerator. The chassis also has space for three 5.25-inch accessible drive bays and two 3.5-inch internal drive bays.

The DX/33's performance was subpar. Its Graphics WinMark scores were below average, and its Winstone result was in the cellar. The system's DOS scores did not improve its standing in its CPU category.

The DX2/66 version fared much better, performing about average for its CPU group on our Graphics WinMark tests. Most DOS results were average, but good video performance helped it achieve a DOSmark score that was above average for its CPU class.

NMC includes a one-year parts, two-years labor warranty with toll-free phone support.—JQ

• **National MicroComputers**, 3855 South 500, West Salt Lake City, UT 84115; 800-424-2983.

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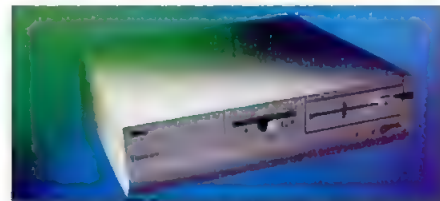
NCR Corp.

AT Local-Bus Workstation (Desktop)

NCR is the latest major computer maker to enter the direct-market arena. Its AT Local-Bus Workstation line is aimed at small and large businesses seeking good performance and outstanding service.

Tough and sturdy, these low-profile, small-footprint PCs aren't intended to accommodate much expansion. The

\$3,275 486SX/33 model comes with just a 3.5-inch floppy disk drive and a 340MB IDE hard disk and has room for one more 5.25-inch externally accessible device. The \$3,830 486DX2/66 model includes a 5.25-inch floppy disk drive but no room for internal storage expansion.



The motherboard is highly integrated, including a Cirrus video controller, IDE controller chip, CPU ZIF socket, and I/O connections; three ISA slots are open.

Overall, the machine performed well. The SX turned in a good Winstone score for its CPU category, but its Graphics WinMark score trailed the others. The video controller made up some ground in DOS testing. The DX2 model won't attract attention as a hot Windows prospect, but it is a good compromise between DOS and Windows applications.

With NCR's 24-hour support, a three-year parts-and-labor warranty, and free on-site service, many corporate buyers will find these systems hard to resist.—JQ

• **NCR Corp.** 1700 S. Patterson Blvd., Dayton, OH 45479; 800-637-2600.

Circle 495 on reader service card

NCR AT Local-Bus Workstation (Desktop)

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

NMC Universal Pro-System

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	FAIR

NCR Corp.

AT Local-Bus Workstation (Tower)

NCR's AT Local-Bus Workstation (Tower) is a step up from this line's desktop configuration. The tower configuration offers solid performance and more expansion possibilities.

Housed in a mini-tower case, the Tower was tested in 25-MHz 486SX (\$3,535) and 50-MHz 486DX2 (\$3,970) configurations. These PCs use ZIF processor sockets and flash BIOS. Memory can be expanded to 64MB without changing SIMMs on the motherboard.

The DX2 model has room for two additional 3.5-inch hard disks and one accessible 5.25-inch peripheral. The SX lacks a 5.25-inch floppy disk drive and thus has room for an additional accessible 5.25-inch peripheral. Both have four free ISA slots and two VL-Bus expansion slots.



NCR AT Local-Bus Workstation (Tower)

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	GOOD
Overall value	GOOD

yielding middle-of-the-pack Windows disk scores; DOS performance was excellent.

The systems come with all the documentation you could ask for, plus extensive service and support. NCR covers its PCs with a three-year, on-site service warranty, including parts and labor.—JQ
• **NCR Corp.** 1700 S. Patterson Blvd. Dayton, OH 45479; 800-637-2600.
Circle 495 on reader service card

NEC Technologies Inc.

Image 486 Series

NEC's well-earned reputation for designing and building high-quality PCs is augmented by consistent high performance, although its prices remain high.

We tested two models in the Image 486 Series: a \$3,767 486DX/33 and a

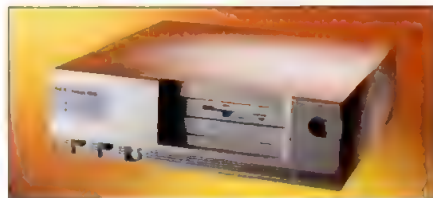


Image 486 Series

SUITABILITY TO TASK	
DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	GOOD
Overall value	EXCELLENT

with on-board I/O, Ethernet, IDE, SCSI controllers, a local-bus Tseng ET4000/W32 video accelerator, and four open ISA slots.

The DX turned in well-above-average Graphics WinMark and Winstone scores for its CPU class. Its DOS scores were excellent: the second-highest processor and video scores in its class and a DOSmark score among the top ten. But disk performance was below average. The DX2 did well in the Windows tests, staying comfortably in the top 30 among all tested machines. DOS video scores were top-notch, just behind the class leader. By year-end, NEC will add an Energy Star-compliant system including a faster Tseng W32i video controller, two VL-Bus connections, and Fast SCSI-2 support.

NEC has one of the best service policies around—a three-year parts-and-labor warranty and one year of free on-site service.—JQ

• **NEC Technologies Inc.** 1414 Massachusetts Ave., Boxborough, MA 01719; 800-632-4636.
Circle 496 on reader service card

Pactron Integration Computer Inc.

Pactron PowerPAC

The otherwise nondescript Pactron PowerPAC desktop systems do use an unusual mix of ISA, EISA, and VL-Bus slots. But the models we tested—a \$2,350 486DX/33 and a \$2,550 486DX2/66—weren't exactly Windows trailblazers.

The systems come in small-footprint cases with only two 5.25- and one 3.5-inch drive bays available. Of the four 16-bit ISA and one EISA expansion slots, three can't hold full-length cards because of the CPU's piggybacked heat sink/fan. Pactron uses ZIF sockets for processor upgrades, including Intel's forthcoming Pentium-based P24T OverDrive chip.

The two VL-Bus slots come filled with a Diamond Stealth 24VL video adapter and a Promise Technology IDE hard disk controller with a 1MB cache. Along with a 340MB IDE hard disk, these components worked well on DOS tests but had difficulty keeping up on Windows tests.

The PowerPACs barely held on to



above-average positions on DOS tests, relying on good video and reasonable disk performance. In Windows, the 1MB controller cache helped improve disk results, but the machines' video performance sank. Together, these results yielded below-average Winstone scores for the units' respective CPU categories.

Pactron offers a standard one-year parts-and-labor warranty.—JQ
• **Pactron Integration Computer Inc.** 9421 Winnetka Ave., Unit L, Chatsworth, CA 91311; 800-775-8766.
Circle 497 on reader service card

PowerPAC	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	EXCELLENT

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- Plenty of room to grow: 5 slots (includes 1 VESA Local Bus slot), 5 bays
- A super combination of speed, power, upgradability and expandability
- IBM 14V 14" SVGA NI Monitor



ValuePoint Mini-Tower

- Convenient, compact Mini-Tower processor case measures 9.5" W x 16.8" H x 16.9" D
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ValuePoint Si	425SX/SI	425SX/SI	433DX/SI	425SX/SI
Processor	i486SX/25MHz	i486SX/25MHz	486DX/33MHz*	i486SX/25MHz
Hard Drive/Memory	120MB/4MB	212MB/4MB	120MB/4MB	120MB/4MB
Drive(s)	3.5"	3.5"	3.5"	3.5" & CD-ROM
Monitor	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 6318 14" SVGA	IBM 14V 14" SVGA NI
Operating System	IBM DOS & WINDOWS™	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS
Price*/ IBM Credit Lease**	\$1,489 / \$54 per month	\$1,599 / \$58 per month	\$1,679 / \$61 per month	\$1,804 / \$65 per month
ValuePoint DeskTop	425SX/D	433DX/D	425SX/D	433DX/D
Processor	i486SX/25MHz	486DX/33MHz*	i486SX/25MHz	486DX/33MHz*
Hard Drive/Memory	170MB/4MB	212MB/4MB	245MB/4MB	340MB/4MB
Drive(s)	3.5"	3.5"	3.5" & CD-ROM	3.5"
Monitor	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 6318 14" SVGA
Operating System	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS
Price*/ IBM Credit Lease**	\$1,709 / \$62 per month	\$2,059 / \$74 per month	\$2,134 / \$77 per month	\$2,069 / \$75 per month
ValuePoint Mini-Tower	433DX/T	433DX/T	433DX/T	466DX2/T
Processor	486DX/33MHz*	486DX/33MHz*	486DX/33MHz*	i486DX2/66MHz
Hard Drive/Memory	340MB/4MB	340MB/4MB	340MB/8MB	527MB/8MB
Drive(s)	3.5"	3.5" & CD-ROM	3.5" & CD-ROM	3.5"
Monitor	IBM 6318 14" SVGA	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 15V 15" SVGA FS NI
Operating System	IBM DOS & WINDOWS	IBM DOS & WINDOWS	OS/2*	IBM DOS & WINDOWS
Price*/ IBM Credit Lease**	\$2,179 / \$79 per month	\$2,654 / \$96 per month	\$2,854 / \$103 per month	\$3,399 / \$122 per month

* Some 486DX/33MHz processors may be manufactured by IBM. ** ValuePoint Si systems do not include all features listed above chart. Please refer to product details listed at left, or call for more information. ValuePoint Si prices listed reflect IBM Basic Keyboard only. IBM Enhanced Keyboard available at additional cost.

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Personal Computer Graphics Corp.

PCG Turbo Burst

There are plenty of superlatively named PCs in this roundup, but Personal Computer Graphics' midsize tower systems actually deserve the *Turbo Burst* moniker.

The two tested systems led their CPU categories in Windows performance. The 486DX2/66 unit (\$3,097) even beat out the only Pentium-based system here.

Priced from \$2,772 to \$3,547, these units came with 340MB IDE drives attached to VL-Bus disk controllers, each with 2MB of cache memory. Each had a VL-Bus Photon Torpedo 9000 video card based on the Weitek Power 9000 chip.

In its CPU category, the 486DX/33 (\$2,772) placed first on our Winstone, Disk WinMark, and Graphics WinMark tests. But DOS results were unexceptional. The 486DX2/66 did even better under Windows. It took top honors on our Graphics WinMark and Winstone tests not only within its class but overall as well. Again, its DOS test results were less sparkling.

Each system has one free VL-Bus slot and four free 16-bit ISA slots. PCG uses dual floppy disk drives, so you get three open 5.25-inch accessible drive bays and one internal 5.25-inch bay.

PCG offers free on-site service (with parts and labor) for the first year, with an additional four years of coverage on parts.—JQ

• **Personal Computer Graphics Corp.**, 3914-901 Del Amo Blvd., Torrance, CA 90503; 800-255-9893.

Circle 498 on reader service card

Polywell Computers Inc.

Poly 486EV

Configured to be network servers or high-end workstations, Polywell's EISA-based Poly 486EV PCs perform very well and come at a very attractive price.

We evaluated a 486SX/33 (\$2,750) and a 486DX2/66 (\$3,150) model from the Poly 486EV line. The PCs come in medium-size tower cases with five free EISA slots and three VL-Bus expansion slots. Two VL-Bus slots are occupied: An Orchid Technology P9000/VLB graphics adapter handles video, while data storage is handled by a Tekram IDE hard disk controller with 64K of cache wired to a Western Digital 340MB hard disk.

The 66-MHz 486EV garnered the fifth spot overall in processor testing and achieved top-ten rankings in Winstone and Graphics WinMark test results. DOS test results were average, although video results were quite low. The SX/33 model

had the same DOS-based low points, but failed to compensate with excellent Windows test results.

If you want to increase the features of any Poly 486EV unit, you'll find the interior of these systems a bit tight. The CPU fan on the DX2/66 system prevents a VL-Bus and an EISA slot from using full-length cards.

Polywell's warranty is better than most, covering parts and labor for two years, with an additional three years of labor-only coverage. On-site service costs \$75 for the first year.—JQ

• **Polywell Computers Inc.**, 61C Airport Blvd., South San Francisco, CA 94080; 800-999-1278.

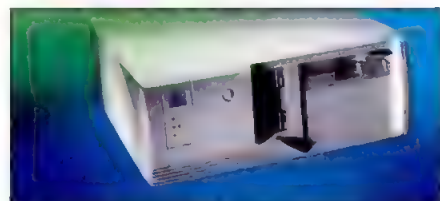
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Quill Corp.

QTech Computers VL Series

Quill Corp.'s QTech Computers VL Series offers PCs with bargain-basement prices that have trouble measuring up in terms of overall performance.

The three small-footprint desktop ISA machines we evaluated—with 486SX/25 (\$2,299), 486DX/33 (\$2,499),



and 486DX2/66 (\$2,699) processors—offer five free 16-bit ISA slots for expansion. Each unit comes with two VL-Bus peripherals—a video adapter based on Weitek's Power 9000 graphics ac-

celerator, and a local-bus IDE hard disk controller with 64K of cache and a 340MB Western Digital Caviar hard disk. Unfortunately, Quill's lack of attention to detail affects these systems' performance in both DOS and Windows.

On the strength of the video adapter, the QTech systems did well on the Graphics WinMark test, but scored below average on the Winstone test because of disappointing Windows disk scores. In DOS evaluations, the PC's video subsystem finished at or near the bottom of each processor class, and processor scores trailed the pack, hurting the system's overall DOSmark score.

Direct-marketer Quill is better known for its office-supply business, and, unfortunately, these machines won't help the company make a name for itself in the PC business. The QTech series is covered by a one-year parts-and-labor warranty with free on-site service.—JQ

• **Quill Corp.**, 100 Scheller Rd., Lincolnshire, IL 60069; 708-634-6650.

Circle 500 on reader service card

PCG Turbo Burst	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	EXCELLENT
Expandability	EXCELLENT
Overall value	EXCELLENT



Poly 486EV	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	GOOD

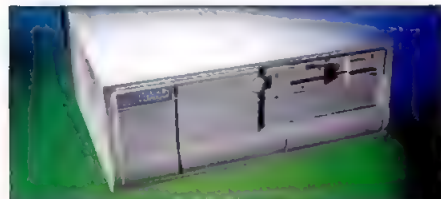


QTech Computers VL Series	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Overall value	EXCELLENT

Reason Technology

Reason Square 4 LXPWA 486

The two Reason Technology PC lines we review in this issue are distinguished from each other by their methods of data storage. The Reason Square 4 LXPWA 486



line comes with standard IDE hard disks, while the LXPWS line uses SCSI controllers and hard disks. The tested configurations of the LXPWA line cost \$2,595 for a DX/33 and \$2,795 for a DX/66.

Using no-tools-needed cases, the ISA/VL-Bus LXPWA systems are easy to get into. Each system comes with a Diamond Viper VL-Bus GUI accelerator based on the Weitek Power 9000 graphics controller.

A VL-Bus IDE hard disk controller manages a Maxtor 540MB IDE hard disk.

The LXPWA models feature six free 16-bit ISA slots for expansion and room for five drive bays—two of which are open. The heat sink on the DX2/66 model partially blocks two of the unoccupied ISA slots.

In their respective CPU classes, the LXPWA DX/33 and DX2/66 systems are average performers in DOS and Windows environments. And even though these models use standard IDE hard disks (compared with the LXPWSs' Fast SCSI-2 hard disks), they manage to do as well in Windows applications.

Computer neophytes won't be enlightened by Reason Technology's basic manuals. The company includes a two-year parts-and-labor warranty.—JQ

• Reason Technology, 290 Coon Rapids Blvd., Minneapolis, MN 55433; 800-800-4860.

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Reason Technology

Reason Square 4 LXPWS 486

Similar to Reason Technology's LXPWA line, The Reason Square 4 LXPWS 486 models come outfitted with many of the same components, save for one—a Fast SCSI-2 hard disk subsystem. You'll pay \$300 extra for comparably equipped members of the LXPWS family, but won't see a major performance benefit.

The \$2,895 LXPWS DX/33 and \$3,095 LXPWS DX2/66 come with VL-Bus graphics accelerators based on the Weitek Power 9000 chip. Each system's other VL-Bus connector holds a Fast SCSI-2 disk controller connected to a Seagate 540MB SCSI hard disk.

For easy access to each system's five free 16-bit ISA slots (a sixth is occupied by an I/O card), the LXPWSs come in no-tools-needed cases. Each system's eight SIMM sockets were only half filled to meet our 16MB of RAM test requirement. A case can also hold up to three more storage devices.

Neither LXPWS unit had spectacular benchmark test performance, but both did well enough in their respective categories. The DX/33 delivered average Winstone and DOSmark scores. The DX2/66 model showed more of its potential hard disk strength, but its overall results also remained average for its group.

The two-year parts-and-labor warranty can be beefed up with a \$50 one-



year on-site service policy.—JQ

• Reason Technology, 290 Coon Rapids Blvd., Minneapolis, MN 55433; 800-800-4860.

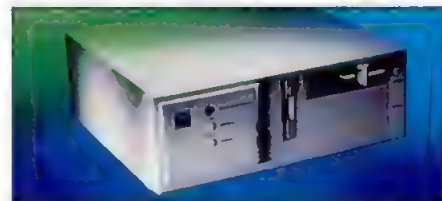
Circle 501 on reader service card

Swan Technologies Inc.

Swan 486 Direct Bus

One of the first personal computer manufacturers to offer local-bus video, Swan Technologies continues to attract users by adding some extras, such as internal modems, communications software, and CD-ROM drives, to its top-of-the-line systems.

Priced at \$2,847 for the SX/25 and \$3,487 for the DX2/66 we evaluated,



these models come in standard desktop AT-style cases with ISA/VL-Bus motherboards. Both come armed with the Orchid P9000/VLB VL-Bus graphics accelerator and an IDE VL-Bus controller for the 450MB Seagate IDE hard disk. An added bonus is the inclusion of an internal 2,400-bps modem, leaving four free 16-bit ISA slots. The cases have two open 5.25-inch drive bays, one front-accessible 3.5-inch bay, and room for two more internal 3.5-inch hard disks under the power supply.

Though each system earned high scores on the Graphics WinMark tests—the SX/25 lead its processor class—the systems were only average on our Winstone tests, which are a measure of Windows applications performance. Processor scores were on a par, but DOS video scores fell to the back of the pack.

Swan Technologies offers a generous two-year parts-and-labor warranty with free on-site service for the warranty period.—JQ

• Swan Technologies Inc., 3075 Research Dr., State College, PA 16801; 800-382-4924.

Circle 502 on reader service card

Reason Square 4 LXPWA 486

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

Reason Square 4 LXPWS 486

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

Swan 486 Direct Bus

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD

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Sys Technology Inc.

Sys Jumbo Tower-EISA/VESA

Although targeted at power users, the Sys Jumbo Tower-EISA/VESA machines are more appropriate as dedicated DOS systems. Their Windows performances were adequate.

Priced in line with other EISA offerings, the Jumbo Tower units range in price from \$2,686 to \$3,159. We tested a \$2,899 486DX/33 and a \$3,159 486DX2/66, each with two VL-Bus and six EISA slots. The local-bus slots are occupied by a Tseng Labs ET4000/W32-based Expedia video controller and an IDE hard disk controller hooked up to a Maxtor 345MB hard disk.

The interiors of these systems are sloppily designed and constructed: Neither systems' CPU can be upgraded and an extra fan that clearly does not fit properly hangs at an awkward angle, anchored with plastic ties.

Sys's DX/33 Jumbo Tower did make a better performance impression than its 66-MHz sibling. In DOS outings, the 33-MHz system stayed in the top third of its CPU class. Windows results were mixed: below-average disk scores, above-average graphics scores, and an average Winstone result. The DX2/66 model did well in DOS rankings, with a DOSmark in the top 15 overall. Windows performance was just below average for a DX2/66.

Sys offers a one-year parts warranty, with free lifetime labor.—JQ

• **Sys Technology Inc.**, 10655 Humbolt St., Los Alamitos, CA 90702; 310-498-6888.

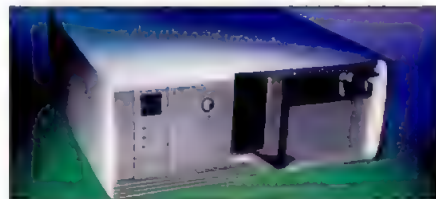
Circle 503 on reader service card

Sys Technology Inc.

Sys Medium Desktop-VESA

Similar in design to Sys Technology's Jumbo Tower models, the Sys Medium Desktop-VESA systems raise many of the same concerns. A lack of attention to detail and below-average Windows performance won't attract much of an audience.

We tested two ISA Medium Desktop-VESA systems: a \$2,619 486DX/33 and a \$2,879 486DX2/66. Sys Technology packs into these PCs the same Expedia ET4000/W32-based graphics accelerator, IDE hard disk controller, and Maxtor 345MB hard disk used in the Jumbo Tower systems. The case was poorly designed with the ventilation fan partially blocking one VL-Bus slot in one of our test units, and in the other it partially blocked three ISA slots. All of the system's SIMM sockets were filled, requiring chip replacement for a RAM upgrade



beyond 16MB.

Neither Medium Desktop system will entice power Windows users. Winstone scores were below the average on both systems because of poor hard disk performance in the Windows environment. The only high point was average Graphics WinMark test results. DOS testing revealed poor disk scores but excellent video performance, adding up to average DOSmark score.

The unit has a lifetime warranty on labor and one year of coverage on parts.—JQ

• **Sys Technology Inc.**, 10655 Humbolt St., Los Alamitos, CA 90702; 310-498-6888.

Circle 503 on reader service card

Tangent Computer Inc.

Tangent Black Box Pro Series

Designed for users seeking an EISA/VL-Bus system, the Tangent Black Box Pro Series charges premium prices for better than average performance.

Housed in a mini-tower case, each Tangent model uses what the company calls a Universal Bus setup, which contains five 16-bit ISA, one EISA, and two VL-Bus slots. Our test units, a \$3,445 486DX2/50 and a \$3,590 486DX2/66, each came with a Hercules Graphite Pro video adapter based on the IIT AGX015 chip set with 1MB of VRAM and an EISA 2MB controller combined with a Maxtor 345MB hard disk.

The Black Box 486DX2/50 was an average Windows performer. DOS testing was handled well, with the cached disk controller assisting in hard disk tests and helping to turn in an average DOSmark for the unit's CPU class. The 486DX2/66 did well in its category, but DOS video held back overall DOS scores. Winstone scores were average for both systems.

The Black Box cases do cause some expansion hardship: The combination heat sink and fan limits usage of two expansion slots to 3/4-length cards. And because of system configuration, all three front-accessible 5.25-inch bays are occupied, one by the hard disk.

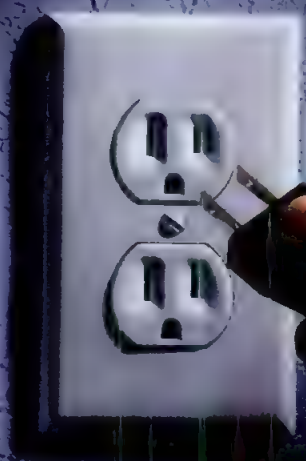
Tangent includes a one-year parts and labor warranty with on-site service.—JQ

• **Tangent Computer Inc.**, 197 Airport Blvd., Burlingame, CA 94010; 800-800-5550.

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Sys Medium Desktop-VESA	
SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Overall value	EXCELLENT

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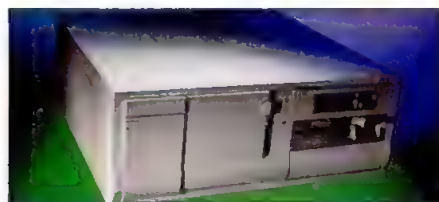
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Tangent Computer Inc.

Tangent VL

The two Tangent VL models we reviewed represent both ends of the performance spectrum. The \$3,590 486DX2/66 system is a good high-end performer at a fair price, but the \$2,225 Cyrix Cx486 S40-based model is strictly an entry-level system.

Both models come in no-tools-needed



Tangent VL

SUITABILITY TO TASK

DOS applications	EXCELLENT
Windows applications	GOOD
Expandability	GOOD
Overall value	FAIR

desktop cases but have limited expansion room. Three 16-bit and two 8-bit ISA slots are available, but in the Cyrix-based system, the CPU's heat sink limits three slots to

accommodating only half-length cards.

The VL line comes with two VL-Bus slots, one equipped with an IDE disk controller and one with a Hercules graphics adapter based on Tseng Labs' ET4000/W32i. However, even the adapter couldn't bolster the Cyrix-based desktop's poor Windows scores. Its processor scores were some of the lowest we tested. In DOS video, however, this unit ranked 12th among all systems tested.

Windows users will be much happier with the 486DX2/66 Tangent VL's performance. The unit did very well in Winstone tests, staying in the top 20 in this crowded class. In DOS, it was also one of the top-ten performers in this group, mainly thanks to good processor and video performance.

A one-year parts-and-labor warranty including on-site service covers these systems.—JQ

• **Tangent Computer Inc.**, 197 Airport Blvd., Burlingame, CA 94010; 800-800-5550.

Circle 504 on reader service card

TC Computers

TC VESA Video Pack

Priced from \$2,599 to \$3,149, the TC VESA Video Pack systems might seem attractive to users interested in multimedia. Unfortunately, performance of the \$2,759 486SX/33 and the \$2,859 486DX/33 didn't measure up to comparably priced systems.

The Video Pack series fits a lot into a standard desktop case. In addition to a Western Digital Caviar 340MB IDE hard disk with a cached 2MB VL-Bus controller, the ISA systems include an internal 9,600-/2,400-bps fax/modem, a double-speed Texel CD-ROM drive, and a Media Vision Spectrum 16 sound card. TC Computers also includes an STB PowerGraph VL-24 graphics adapter based on the S3 P86C805. There's still room for one more 5.25-inch and another 3.5-inch drive.

With a 128K cache, the 486SX/33's processor and DOSmark results were last in its category. In Windows, the cached disk controller was not able to save the system from below-average Disk WinMark and low Winstone results.

The 33-MHz



DX model didn't do much better, yielding the lowest DOSmark in its class. Graphics WinMark scores were average, and Disk WinMark performance lagged; making this system disappointing for Windows users.

The company's warranty covers parts for two years and labor for the life of the system.—JQ

• **TC Computers**, 1310 Carroll St., Kenner, LA 70062; 800-723-8282.

Circle 505 on reader service card

TC Computers

TC Windows Workstation Powerhouse

The ISA-based TC Windows Workstation Powerhouses, priced from \$2,899 to \$3,699, may be a few hundred dollars more than TC Computers' Video Packs, but you get better performance and tower cases.

Equipped with 527MB Conner IDE hard disks attached to VL-Bus controllers with 2MB of cache, the Windows Workstations we tested—a \$3,499 486DX/33 and a \$3,699 486DX2/66—have many features similar to the Video Packs: fax/modems, CD-ROM drives, and Media Vision 16-bit sound cards. TC adds a Diamond Viper GUI accelerator card with 2MB of video RAM to the system. The standard tower cases give you four free drive bays and four free expansion slots.

The 486DX/33 Powerhouse does much better in tests than the 486DX/33 VESA Video Pack, earning an average DOSmark rating. In Windows, disk performance was average and graphics performance was above average. The DX2/66's DOS performance was below average, with hard disk performance providing the only bright spot. The hard disk subsystem did not perform as well under Windows. Both machines had average Winstone results.

The Powerhouses have two-year parts and lifetime labor warranties.—JQ

• **TC Computers**, 1310 Carroll St., Kenner, LA 70062; 800-723-8282.

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TC Windows Workstation Powerhouse

SUITABILITY TO TASK

DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	GOOD

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Touche Micro Technologies

Touche ISA VLB

The Touche ISA VLB PCs offer well-rounded Windows performance at reasonable prices. Ranging from \$2,699 to \$3,399, these midsize tower systems aren't the biggest or the fastest, but they



offer reasonable values.

The ISA VLB systems include Orchid Technology Celsius VL-Bus video adapters based on IIT's AGX015 video accelerator chip. What really helps this line's Windows performance is the hard disk subsystem, a combination of the Maxtor 340-MB SCSI hard disk and VL-Bus controller with 4MB of cache.

The \$2,699 DX/33 model's

DOS performance was hampered by poor DOS disk performance, resulting in a midlevel DOSmark rating. But in Windows testing, the DX/33 turned in one of the top ten hard disk scores in its category. Coupled with good graphics results, it turned out a top-ten Winstone score. With a DX2/66 CPU, the Touche was just above average in Windows performance. DOS disk and video performance were far behind those of the leaders, but excellent processor performance resulted in an average DOSmark score.

The ISA VLB cases have room for three 3.5-inch and two 5.25-inch devices. There are five free 16-bit ISA slots, although the CPU's fan prevents the use of full-length cards in three of the slots.

Touche backs its machines with two-year parts-and-labor warranties.—JQ

• **Touche Micro Technologies** 23824 Andrew Rd., Plainfield, IL 60544; 815-439-9000.

Circle 506 on reader service card

Tri-Star Computer Corp.

Tri-CAD VL-Station

Tri-Star Computer Corp.'s Tri-CAD VL-Stations are undoubtedly aimed at CAD users who demand high-quality graphics performance.

These systems come with high-end monitor options and high prices (\$5,295 for a 486DX/33 and \$5,495 for a 486DX2/66 in our test configurations). The full-tower ISA-based Tri-CAD systems both came loaded with CD-ROM drives, Aztech Sound Galaxy NX Pro 16 sound cards, and removable 425MB Western Digital IDE hard disks. VL-Bus IDE disk controllers with 16MB of cache memory support disk storage and are largely responsible for the computers' prices.

The Tri-CAD machines also come with Orchid VL-Bus video adapters based on Weitek's Power 9000 chip. Our

systems also included 17-inch MAG monitors.

The DX/33 and DX2/66 models were above-average Windows performers with good graphics performance. DOS results were slightly below average. In Windows, disk performance trailed the pack, but when combined with graphics performance, it brought in an above-average Winstone score.

Tri-Star includes the HSC InterActive SE multimedia authoring package with its systems, as well as a warranty that covers the units for two years on parts and a lifetime on labor. One year of on-site service is included.—JQ

• **Tri-Star Computer Corp.** 120 S. Weber Dr., Chandler, AZ 85226; 800-678-2799.

Circle 507 on reader service card



Unisys Corp.

Unisys PW² Advantage Partner

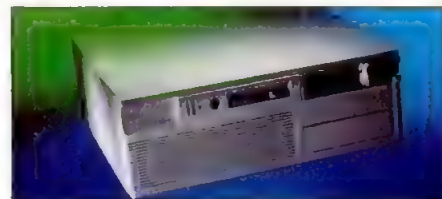
Well designed and sturdily constructed, the highly integrated Unisys PW² Advantage Partners are Energy Star-compliant network client PCs.

The two ISA systems we reviewed sacrifice some performance to meet the EPA's rating, but most corporate buyers will find the trade-offs worth it for these systems.

The two models we tested, an \$1,848 486DX/33 and a \$2,048 486DX2/66, are outfitted with

PW² Advantage Partner

SUITABILITY TO TASK	
DOS applications	FAIR
Windows applications	FAIR
Expandability	POOR
Overall value	EXCELLENT



10BaseT Ethernet adapters. The systems' integrated motherboards include all I/O connections, built-in IDE disk controllers, and Cirrus Logic GD5422 graphics controllers. The Quantum 240MB IDE hard disk and older Cirrus Logic graphics chip mean that the Advantage Partners are not top performers. The 486DX/33 model was just below average for its class in DOS, and Windows scores were significantly below the norm. The 486DX2/66 model didn't fare any better: Its bottom-tier DOS and Windows performance was unimpressive.

What is impressive about these models is their use of very small cases and a T-Bar motherboard design that includes one free proprietary and two free ISA 16-bit slots. There is also space available for two 3.5-inch devices.

Unisys provides a one-year parts-and-labor warranty and free on-site service, and will replace parts on-site if they cannot be repaired.—JQ

• **Unisys Corp.**, P.O. Box 500, Blue Bell, PA 19424; 800-448-1424.

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Unisys Corp.

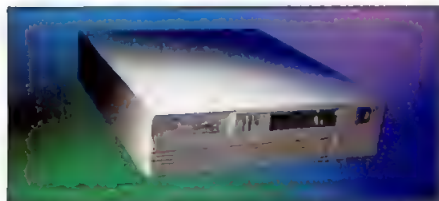
Unisys PW² Advantage

The Unisys PW² Advantage systems are for business users who want more than basic network client PCs.

Priced at \$4,348 for the 486DX/33 and \$4,648 for the 486DX2/66, the systems

► PW² Advantage

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	FAIR
Overall value	GOOD



are built into the system board. The motherboard also has a SCSI-2 controller with internal and external connections and an S3 805 local-bus GUI accelerator. Although these systems do not include NICs, both models arrived with 1GB SCSI hard disks.

The hard disk subsystem and 805 GUI accelerator keep the Advantage line competitive in performance with the majority of machines in the DOS tests. Windows performance drifted a little lower, however, but not distractingly so.

Unisys's clever case design may revive an appreciation for the old AT-size case. The case holds both 3.5- and 5.25-inch floppy disk drives with room for three additional drives. Inside, there are two free VL-Bus slots and four free 16-bit ISA slots. The CPUs can be pulled out to accommodate Pentium-derived upgrades.

Additional attractions include Energy Star ratings for the units with low-end CPUs and thorough owner's manuals. Unisys's one-year parts-and-labor warranty includes free on-site service.—JQ

• **Unisys Corp.** P.O. Box 500, Blue Bell, PA 19424; 800-448-1424.

Circle 508 on reader service card

Unitek Technology Inc.

Unitek LB System

As standalone workstations, The Unitek LB Systems' uninspiring Windows performance won't grab much attention. But the two machines reviewed here do have potential as file servers.

Unitek Technology's plain-Jane EISA 486DX/33 and 486DX2/66 towers list for \$2,945 and \$3,185, respectively. Each comes with a Maxtor 340MB SCSI hard disk with 2MB of cache, and a Fahrenheit VLB graphics adapter based on S3 Corp.'s 86C805 chip. These components won't win any throughput races, but they're sturdy and reliable.

If you want to make these PCs into full servers, their cases will accept another six drives (more could be added by installing additional internal brackets). Each system has one free VL-Bus and four free EISA slots, while the empty SIMM sockets accept another 48MB of RAM (for a total of 64MB) on the motherboard.

The 486DX/33 Unitek model is an average DOS performer, with above-average video. In Windows, the system's below-average disk and graphics performance meant a below-average Winstone score. Unitek's DX2/66 faced stiffer competition, and scored below the average on processor and DOSmark tests.

The units come with a lifetime warranty on labor and a one-year warranty on parts and on-site service.—JQ

• **Unitek Technology Inc.**, 1917 S. Vineyard Ave., Ontario, CA 91761; 800-944-5650.

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► LB System

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	EXCELLENT
Overall value	EXCELLENT

Xinetron Inc.

Xinetron X/Lan 486

Intended as network-ready PCs, the Xinetron X/Lan 486s offer more room for expansion than the company's X/Lan Stations but fail to deliver premium Windows performance.

Available in standard desktop, mini-tower, or slimline configurations, the X/Lan 486 family uses ISA motherboards with two VL-Bus slots, one of which contains Actix's GraphicsEngine 32VL video board based on the S3 86C805 chip. The other VL-Bus connection holds an IDE disk controller with a 4MB cache to assist its Maxtor 345MB IDE hard disk.

In each of our test systems—a \$2,585 mini-tower 486DX/33 model and a desktop \$2,699 486DX2/66 model—one ISA slot came outfitted with a Xinetron Ethernet card, leaving one eight-bit and four 16-bit ISA slots free for expansion. Both the mini-tower and desktop systems can each take three additional drives.

The DX/33 earned above-average DOS test scores, with video contributing significantly to the overall performance mix. The unit's video adapter helped it earn average Graphics WinMark and Winstone scores. The DX2/66 did very well in DOS video tests but its disk subsystem held it back. Disk scores also hurt its overall Windows performance, and its Winstone score was below average.

X/Lan 486s include a three-year parts-and-labor warranty.—JQ

• **Xinetron Inc.**, 2302 Walsh Ave., Santa Clara, CA 95051; 800-345-4415.

Circle 510 on reader service card



► X/Lan 486

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	FAIR
Expandability	FAIR
Overall value	GOOD

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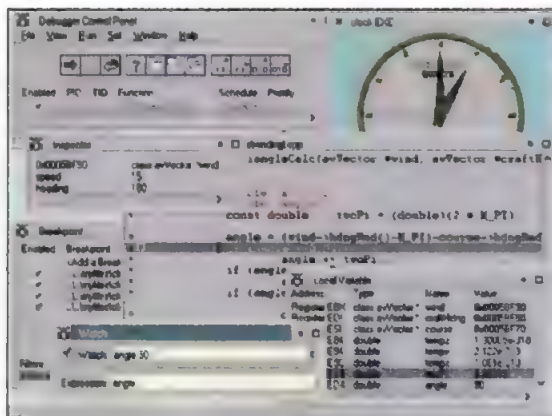
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The Brachiosaurus
Was it a giant meteor? Global cooling? Who knows what finished this guy off. In any case, he was positively passé by the end of the Mesozoic era.



The Ford Edsel
"Out" even before it was "in." Apparently, the saying that everyone enjoys 15 minutes of fame doesn't apply to the automobile kingdom.



Typical Antivirus Software.
Needs to be updated every month. Useless against the three new viruses coming out each day. Almost as technologically advanced as a Slinky.

It's called Norton AntiVirus™ 3.0 (NAV) for Windows and DOS. It has a brand new Windows interface that makes it easier to use and configure. And it makes other antivirus software look as up-to-date as the leisure suit.

That's because it fights both known viruses and new ones that come out every day. So you don't need to keep raiding your wallet to update your protection, something you'd have to do with other products.

Here's how NAV works. First, it scans your files for known viruses - it recognizes over 2,000 of them. Once discovered, they're automatically eliminated from your system.

Next, NAV takes care of unknown viruses, something that most other software can't do. Using our patent-pending Symantec Novi Virus Sensor Technology, NAV runs rule-based integrity checks to compare current file characteristics with a snapshot stored in RAM before the program is executed. When it notices viral activity, it instantly kills it. NAV also repairs damaged file areas before the virus can complete its dirty work.

For even further protection, NAV

alerts you to changes being made to your files — by some anonymous virus, for example. Bad news for even the most clever viral code.

And because NAV scans for viruses faster than any other software, you'll never feel tempted to deactivate the scan to avoid waiting. Plus, you can schedule automatic scans for times when you're not using your computer.

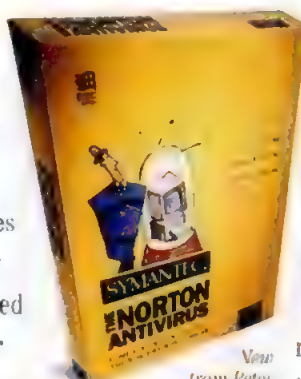
NAV also comes with a network installer* for remote installation, requires very little memory space, and is

even available to you in a Netware Loadable Module (NLM) version.

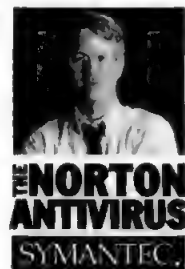
As if all this weren't enough, NAV is both a PC World Best Buy and a PC Magazine Editor's Choice for March '93. So there you have it.

If you'd like more information (via fax) about the only product that can offer you total, up-to-the-minute antivirus protection, please dial 1-800-554-4403, select option 1 and request document 449. Then go ahead and put that other antivirus software where it belongs.

Upstairs in the attic with your prized collection of disco records.



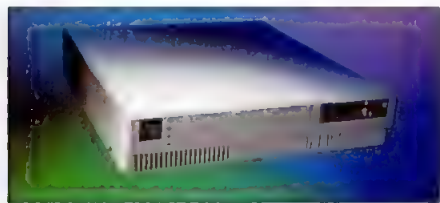
New from Peter Norton, the biggest name in virus protection.



Xinetron Inc.

Xinetron X/Lan Station

The slimline Xinetron X/Lan Stations, priced from \$1,299 to \$2,699, are designed strictly for corporate network use. But Xinetron has made some sacrifices to get the prices of these ISA-based units down to \$2,499 for the 486DX/33 and \$2,699 for a 486DX2/66 we tested. Notable in this regard is the video subsystem,



► X/Lan Station

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	POOR
Overall value	EXCELLENT

which hampered performance. It is based on the out-dated Tseng ET4000 VGA controller and contains only 128K of external processor cache.

Not surprisingly, the DX/33 X/Lan Station delivered an average DOSmark score with good video and disk performance thanks to a Maxtor 345MB IDE hard disk and a 1MB cached hard disk controller. Windows results were marred by the ET4000's poor graphics performance, giving the DX/33 X/Lan Station one of the lowest Winstone results in its CPU class.

The DX2/66 was also a reliable player in DOS, with good video and above-average hard disk scores. In Windows, however, the system's hard disk and video subsystems fell behind, yielding a very low Winstone score.

Also unlikely to inspire confidence is the X/Lan Station's makeshift motherboard arrangement, which limits expansion. One expansion slot is taken by an all-in-one Ethernet card with AUI, BNC, and RJ-45 connections.

Xinetron provides a three-year parts-and-labor warranty.—JQ

• **Xinetron Inc., 2302 Walsh Ave., Santa Clara, CA 95051; 800-345-4415.**

Circle 510 on reader service card

ZEOS International Ltd.

ZEOS Upgradable

Dressed in standard desktop cases, the ZEOS Upgradable 486DX/33 and 486DX2/66 machines we tested are tidy, sturdy systems that deliver good Windows performance and excellent value.

Coming from a reputable direct marketer with 24-hour phone tech support, ZEOS's prices—\$3,042 for the DX/33 and \$3,242 for the DX2/66 model—should seem reasonable. When you open up these systems you'll see in the ISA/VL expansion bus a Diamond Viper VL-Bus GUI accelerator. Everything else from IDE disk control to I/O circuitry is integrated onto the motherboard, leaving one VL-Bus, one eight-bit ISA, and five 16-bit ISA slots free. The system includes a Seagate 527MB hard disk; ZIF sockets allow for P24T upgrades, and three of four SIMM sockets are open for additional memory.

Both ZEOS models were average in DOS testing, with only video scores drifting below the average. In Windows, however, the Weitek Power 9000-

► ZEOS Upgradable

SUITABILITY TO TASK	
DOS applications	GOOD
Windows applications	GOOD
Expandability	GOOD
Overall value	EXCELLENT



based graphics adapter did justice to the systems. The DX/33 system was in the top five in its CPU class. Both machines brought in Winstone scores significantly better than the average.

ZEOS includes helpful owner's manuals, documentation for all the important components, a choice of software, and a standard one-year parts-and-labor warranty with these units.—JQ

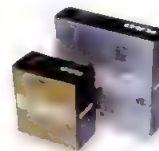
• **ZEOS International Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413; 800-554-7172.**

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CIRCLE 318 ON READER SERVICE CARD

2MB VIDEO BOARDS

Pumping Pixels

The new breed of graphics accelerator boards raise the bar on Windows video performance.

by John R. Quain

For this review—*PC Magazine's* largest roundup of graphics accelerator cards ever—we put 43 video adapters through their paces. Using our newly developed suite of more rigorous benchmark tests, we uncovered the strengths and weaknesses of 24 vendors' video boards that play in the Microsoft Windows accelerator arena.

Strong new entries from Appian Technology and Matrox Electronic Systems have arisen to challenge previous accelerator champions based on S3 and ATI chips. Four new mighty Windows boards based on the Weitek P9000 chip also have gained the leading edge.

Meanwhile, vendor competition has driven prices to their lowest levels yet. Bargain hunters will find 2MB adapters based on the Cirrus Logic GD5428 controller for under \$150 on the street, as well as boards using the Tseng ET4000/W32i chip for around \$200. Windows power users will still have to pay up to \$600 for the better 2MB boards, but high-end graphics users will find that prices have dropped significantly—from several thousand dollars to less than \$900—for boards like the Matrox MGA Ultima.



REVIEW CRITERIA

Because there are hundreds of video adapters on the market, we focused on the top mainstream graphics accelerator cards—fixed-function accelerators that use 2MB of on-board memory. Increasing numbers of Windows users are working with more sophisticated graphical applications and are opting for larger monitors. These users demand more from their video cards, and the video cards require more memory to support higher resolutions and more colors. Thus, the mainstream is gradually rising from 1MB to 2MB boards.

To qualify for this review, each video accelerator card had to have exactly 2MB of memory (although it could have sockets to accept more); support 800-by-600 resolution with 256 colors at a noninterlaced 72-Hz vertical refresh rate, which is the standard set by the Video Electronics Standards Association (VESA); and support 1,024-by-768 resolution with 256 colors at a noninterlaced 70-Hz refresh rate (also a VESA standard). Vendors could provide one ISA board and either one EISA or VL-Bus card. We also tested each board in 800-by-600 with 24-bit, true color (16.7 million colors) and 1,280-by-1,024 with 256 colors if it supports these modes.

We did not include boards with coprocessors in this roundup. Coprocessors, which have occupied the high end of the graphics-board market, are distinguished from GUI accelerator chips by their ability to execute C programs.

Although graphics accelerator chips can be controlled through software, they mainly rely on built-in graphics functions

to boost performance. Most coprocessor cards are programmed for specialized apps, while graphics accelerator cards are aimed at the most popular graphical applications, namely those that use Microsoft Windows 3.1. Accelerator chips—designed and manufactured in ever-faster cycles—have largely eclipsed the capabilities of coprocessors.

The 43 video adapters we reviewed here offer a wide variety of strengths and features. GUI accelerators from 24 vendors cover 13 chip categories and range in price from the high-end \$995 Nth Edge 1280 (based on the Chips & Technologies F82C481 chip) to the low-cost, \$169 Actix ProStar VL (based on Cirrus Logic's latest GD5428 accelerator).

Many vendors appeal to a variety of needs by offering graphics cards based on different controller chips. Cardinal Technologies, for example, has two VL-Bus boards in this review, a Cirrus Logic-based \$199 card for general business use, and a \$599 Weitek P9000-based board for uncompromising Windows performance.

After evaluating all these GUI accelerators, there is at least one message that comes through loud and clear: If you want top graphics performance, it's time to switch to an advanced-bus PC (VL-Bus or PCI bus). In our last review of video adapters, there were only five that con-

formed to VESA's VL-Bus specification (see "Graphics Accelerators: Waking Up Windows," April 13, 1993).

For this review, the number of local-bus adapters has blossomed to 29. And for the first time, we see VL-Bus video adapters outnumber—and outperform—identically priced ISA boards. By using a VL-Bus connector, video adapters can tap into the wider and faster data path of a PC's local system bus. An ISA video card, for example, has access to the expansion bus running at about 8 MHz across a 16-bit-wide path. By contrast, a VL-Bus adapter can stream information across a 32-bit-wide path at the CPU's external clock speed (33 MHz for our tests).

Users with ISA PCs who are looking for a zippy video upgrade needn't worry. There are 13 ISA boards in this review, as well as one board—the \$599 ELSA Winner 1000—that does double duty as an ISA or EISA card. We also procured an Intel PCI (Peripheral Component Interconnect) 2.0 reference PC to test some prototype PCI video cards. (For more information, see the sidebar "PCI Challenges the VL-Bus" in this issue and the PC story in our issue of November 9, 1993.)

NEW, TOUGHER TESTS

To assess this new generation of video adapters, *PC Magazine* inaugurated an

PC Magazine's
entirely new suite
of benchmark tests
provide new
yardsticks for video
performance.

► IN THIS REVIEW

<i>Actix GraphicsEngine 32plus/2MB</i>318	<i>Cardinal VideoSpectrum VL</i>288	<i>Micro-Labs Ultimate</i>
<i>Actix GraphicsEngine Ultra VL</i>318	<i>Cardinal WarpSpeed</i>330	<i>TrueColor/VL/XL2</i>326
<i>Actix ProStar VL</i>288	<i>Diamond Stealth Pro ISA</i>318	<i>Nth Edge 1280</i>270
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<i>SuperX VGA</i>288	<i>Matrox MGA Ultima, ISA Version</i>314	<i>Volante Warp10LB-2</i>318
<i>Boca Research Vortek VL-VRAM</i>	<i>Matrox MGA Ultima, VLB</i>	<i>Volante Warp20-2</i>310
<i>Accelerator</i>310	<i>Version</i>314	<i>Western Digital Paradise Accelerator Pro</i>310
<i>Boca Research Vortek VRAM</i>	<i>Metheus Premier 928-2M</i>318	<i>Western Digital Paradise</i>
<i>Accelerator</i>310	<i>Metheus Premier 928-VL2</i>318	<i>Accelerator VL Plus</i>326



EDITORS' CHOICE

- *General Windows:* **Appian Renegade 1280/I**
Appian Renegade 1280/V
Cardinal WarpSpeed
- *24-bit graphics:* **Matrox MGA Ultima, ISA Version**
Matrox MGA Ultima, VLB Version

entirely new suite of benchmark tests: PC Bench 8.0, WinBench 4.0, and Winstone 94, Version 1.0. Developed by Ziff-Davis's Benchmark Operation facility, the tests provide new yardsticks for video performance. The results of these tests cannot be compared with those we published in the past, however, so a few words are in order about how to interpret the new benchmark test results. (For a fuller description of the new tests, see the Lab Notes section of this issue.)

The newest and biggest entry in PC Magazine Labs' suite of tests is Winstone. It is an applications-based test suite that employs scripts running 12 popular Windows 3.1 software applications. A system's hard disk and CPU performance account for much of the Winstone score. To level the playing field and isolate video performance, PC Labs tested all 43 GUI accelerators on 486DX2/66 Micron 486 VL PCs in two configurations—with 8MB and with 16MB of system RAM.

For general business users, the Winstone tests are an excellent measure of performance. It uses such best-selling business applications as Paradox for Windows; Lotus 1-2-3 for Windows, Release 4.0; and Microsoft Word for Windows, Version 2.0c. If you're working with large graphics files all day long, however, you shouldn't place too much emphasis on a video adapter's Winstone result when making a buying decision. Even though Winstone includes such graphics-intensive applications as CorelDRAW 4.0 and Aldus PageMaker for Windows 5.0, those applications are given less weight in determining the final Winstone score.

For specialized graphics uses, such as those involving professional paint and image-editing programs, WinBench's new Graphics WinMark suite provides more detailed information about a graphics accelerator's performance. The completely overhauled, Graphics WinMark suite uses 66 different Windows graphics function tests, based on real-world applications, to measure how many pixels per second the video subsystem can process and display.

In this review, some video accelerators performed well on our Winstone tests but posted mediocre Graphics WinMark scores. There are several reasons for such anomalies. First, WinBench is designed to

Boards based on three chip types—the AGC 98032, Matrox MGA, and Weitek P9000—stood out as the top performers. The Appian Renegade 1280/I and Appian Renegade 1280/V each win an Editors' Choice as the top mainstream Microsoft Windows

performers. Based on new chips, these two VL-Bus and ISA boards posted the best WinBench and Winstone scores in their respective bus classes.

Four VL-Bus boards based on Weitek's P9000 chips also posted excellent numbers, and had the advantage of supporting 800-by-600 with 16.7 million colors. The Cardinal WarpSpeed garnered an Editors' Choice because of its slightly better performance, features, and construction.

Our Editors' Choice for high-resolution, true-color (24-bit) graphics goes to the \$849 Matrox MGA Ultima, ISA Version, and the \$899 Matrox MGA Ultima, VLB Version. The VLB Version achieved the best 24-bit-color scores and some excellent WinBench scores. Matrox Electronic Systems is lowering its boards' prices to \$599, making them even more attractive.

HONORABLE MENTION

The Weitek P9000-based Advanced Integration Research Star2000 (\$475), American Megatrends FastView VLB (\$385), and Diamond Viper VLB

(\$499) deserve honorable mentions; they were almost on a par with the Cardinal WarpSpeed.

An honorable mention also goes to three boards based on the Tseng ET4000/W32i—the \$279 Focus 2 the Max TrueSpeed W32i, \$259 Micro-Labs Ultimate True Color/VL/XL2, and \$249 Sigma Designs Concorde VLB. While not as feature-rich, fully functional, or refined as our Editors' Choices, their good test results and low prices make them worth considering.

Honorable mentions go to the Cirrus Logic-based Actix Graphics-Engine Ultra VL (\$399) and Actix ProStar VL (\$169), which are bargain buys for 24-bit graphical and general Windows applications, respectively. The ATI Graphics Ultra Pro VLB also gets honorable mention; it supports 800-by-600 with 16.7 million colors, and its WinBench scores were bested only by the Editors' Choices. Honorable mention goes to the Hercules Graphite Pro and Hercules Graphics VL Pro, which are also capable of true color at 800-by-600.

test the limits of graphics cards by bombarding them with a rapid series of Windows API (application programming interface) calls. By comparison, Winstone makes far fewer calls per second, giving the video adapter time to breathe. Hence some chips, such as Cirrus Logic's GD5428, don't handle the stress of WinBench very well but manage quite well under the Winstone scenario.

Furthermore, some GUI accelerators

boast advanced features such as dithering engines to provide better color effects. But while the Graphics WinMark includes dithering tests, the applications in Winstone tend to downplay such features.

The type of memory used on a graphics card can also affect relative performance differences between Graphics WinMark and Winstone scores. Inexpensive adapters tend to use DRAM (dynamic RAM) rather than more expen-

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Because now that you know the facts in black and white, it's time to see the BJC-600 in color.



Canon

sive VRAM (video RAM). The difference is that VRAM is dual-ported, which lets the graphics controller send display information from memory to the screen while simultaneously bringing new information from the system into memory. Hence, VRAM is a decided plus when handling the rigors of WinBench's Graphics WinMark, but is not as essential when negotiating Winstone tests.

As if this weren't enough to consider, you should also note that if you're upgrading your video adapter, the amount of system memory in your PC can

significantly affect performance. PCs with only 8MB of RAM using a 2MB SmartDrive software disk cache can actually hamper a video adapter's performance. That's because with today's extremely fast accelerators, the pixel bottleneck is often the hard disk subsystem. Consequently, we tested all the adapters in 8MB (with a 2MB SmartDrive cache) and 16MB (with a 4MB cache) memory configurations to find out which GUI accelerators would benefit from the extra RAM. Some Winstone scores improved by as much as 30 percent, indicating just

how fast these adapters can be when given enough room to run.

Last but not least, Windows software drivers written by some vendors can favor one test over another. Indeed, during our testing, nearly every GUI accelerator card initially had trouble completing the Winstone tests—a strong indication that vendors have been concentrating more on attaining high Graphics WinMark scores than on delivering reliable day-to-day graphics performance. It is *PC Magazine's* hope that as Winstone testing becomes more prevalent, buyers will benefit from more stable software drivers.

DOS users needn't despair. PC Bench also includes a more robust suite of DOS video tests. Because many Windows users still tend to use DOS applications (including e-mail), the DOS scores are relevant to the performance of Windows accelerators.

Those interested in AutoCAD performance can still refer to the products' scores on PC Labs' standard AutoCAD test to determine the card with the best 3-D rendering abilities. Remember that if you're trying to compare chip categories, a board's software AutoCAD display-list drivers make a tremendous difference in AutoCAD scores and performance. Many board vendors use supplied AutoCAD drivers (particularly Panacea drivers), while a minority write their own.

NEW CHAMPIONS: APPIAN AND WEITEK

As *PC Magazine's* tests march ahead, so do chip designs. Yesterday's price/performance leaders are today's middle-of-the-pack players. To help you find the review that addresses your needs, here's a brief summary of what we found.

The all-around leaders in this review were boards based on three chip types—the Appian AGC 98032, Matrox MGA, and Weitek P9000. The top Windows performer—and an Editors' Choice winner—is the \$425 Appian Renegade 1280/V, which is based on Appian's own newly designed AGC 98032 controller. Its Graphics WinMark scores narrowly edged out those of the four Weitek-chip contenders, and it generally posted better AutoCAD results. When used with a 16MB system, this Appian board also ran away with the top Winstone ranking. The ISA-based Appian Renegade 1280/I, another Editors' Choice winner, also

HIGHLIGHTS

2MB Video Boards

THIS REVIEW of 2MB video accelerator boards includes 13 chip types. We saw 29 VL-Bus and 13 ISA-bus cards, as well as one ISA/EISA convertible board. Prices range from \$169 to \$995.

OUR NEW BENCHMARK TESTS consist of a suite of applications tasks (Winstone 94) and more rigorous WinBench 4.0 tests. Because these tests differ significantly from previous benchmark tests, results are not comparable with those in previous reviews.

THE TOP-PERFORMING BOARDS are based on three chip types: the AGC 98032, Matrox MGA, and Weitek P9000. Boards based on the Appian and Weitek chips garnered our Editors' Choices in the general Windows category; those using the Matrox chip led in the 24-bit-graphics category. We give honorable mentions to the VL-Bus ATI card and both the ISA and VL-Bus versions of the Hercules board for exceptional performance. The Actix Graphics-Engine Ultra and Actix ProStar VL (both using the Cirrus Logic GD5428) and the boards from Focus, Micro-Labs, and Sigma Designs (based on the Tseng ET4000/W32i) are good bargains.

PRICES DECLINE as video-board performance continues to rise. Products are getting faster and are

supporting higher resolutions, more colors, more sophisticated graphics operations, and advanced features. A key trend among boards in this review was support for 24-bit, true color (16.7 million colors) at 640-by-480 and 800-by-600. Of 43 boards, 22 could support true color at 800-by-600.

ADVANCED FEATURES that were once found mainly on expensive high-end boards are becoming common on mainstream boards, including auto-installation and mode switching, pans and zooms, virtual screens, hardware cursors, stretch Blits (window stretching), and higher refresh rates.

THIS WAS OUR FIRST VIDEO REVIEW in which VL-Bus cards outnumbered ISA-bus cards (by two to one). We also received and tested four prototype PCI-bus cards. There were bugs in all four PCI cards initially, but when these were corrected by the vendors, the cards delivered performance equivalent to or slightly above VL-Bus performance.

BOARDS VARY IN THEIR SCOPE and functionality in terms of general Windows, DOS, AutoCAD, and graphics capabilities. Particular boards were strong in specific categories, others more balanced. They also vary in their resolutions and color depths.



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Linda Dietenhofer
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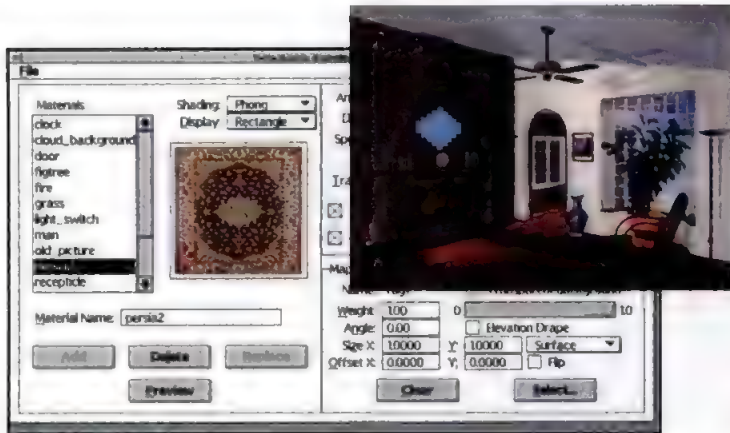
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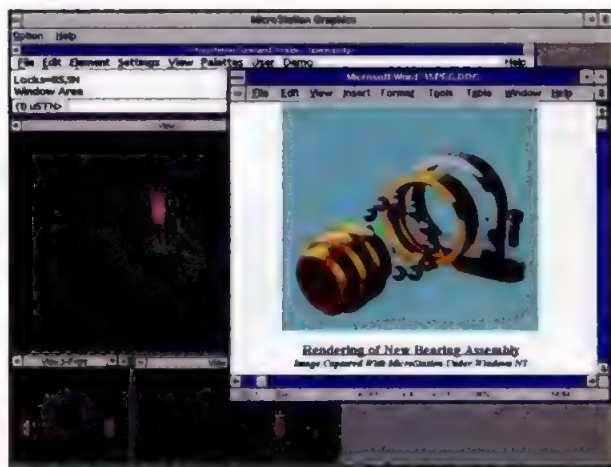
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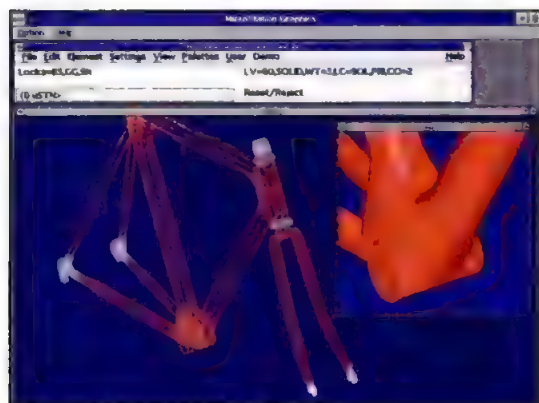


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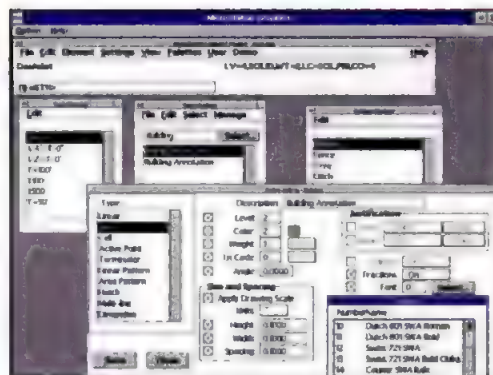
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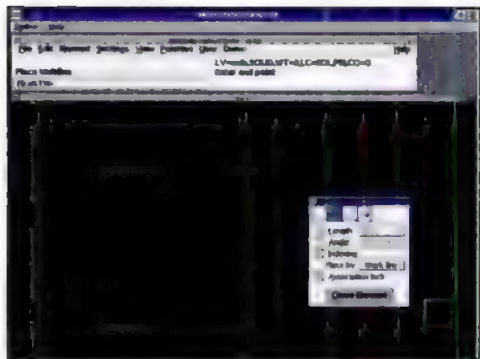
Modeling. Model any surface you can imagine in MicroStation. NURBS surface modeling combined with 3D Boolean operations gives you astounding flexibility in creating and modifying freeform models.

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MicroStation's easy-

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Windows or Motif – on any platform. **Transparent Modeless**

Operation. The software supports the way you naturally work, maintaining command execution while you fine tune: change element attributes or command parameters, manipulate views, change the dimensioning system, and more.

Powerful View Manipulation. MicroStation supports up to eight active views that can be moved, sized, and overlapped to fit your design. Zoom and area at any scale. Move around your design fast with built-in dynamic panning.

Workspace Editor. Tailor pull-down menus, dialog boxes, and tool palettes – even disable commands – with a graphically oriented toolset for customizing your chosen interface.

Text Capabilities. A convenient text editor lets you easily edit single-line or paragraph text. Choose from TrueType, PostScript, AutoCAD SHX, and

MicroStation fonts. ASCII text files can be imported and exported. **Multiple Undo/Redo Commands.** Undo mistakes and perform “what-if”

designs in a flash with unlimited undo and redo. **Plotting.** Plot raster and vector information by view or defined areas, at any scale. Visually preview the plot before

plotting, saving time and materials. **Online HELP.** MicroStation's

HELP remains active, tracking the command you're currently using, so there's no searching through manuals for assistance.

Associative Patterning and Hatching.

Associate patterning with graphics. Change graphics and the patterning updates. Flood-fill hatching/patterning

intelligently fills an area, detecting boundaries

and holes with a single pick. **Associative**

Dimensioning. Dimensions are associated

with the geometry, not with a point in space, so that when you change the

geometry, the dimensions automatically update. **Custom Line Styles.** Create

space-saving custom line styles and place railroad tracks, trees, isobars – anything – just as you would place a line.

Multi-lines. Define line string elements comprising up to 16 parallel lines of varying symbology and store them in a style library for

Architects can use multi-lines for fast and easy placement and intersection cleanup of walls and partitions. **2D Boolean**

ms. Quickly modify, measure, and hatch multiple 2D shapes with integrated Boolean operations. **Mass Properties.** Calculate area and

of your model: surface area, volume, mass, centroid, moments and products of inertia, principal moments and directions, and radii of gyration.

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GRAPHICS HARDWARE

2MB Video Boards

earned the highest Graphics WinMark scores of the ISA cards in this review. These two Appian boards are user-friendly and feature-rich, and each can drive two monitors simultaneously.

Jockeying for the number-two general Windows spot in this review were four VL-Bus cards based on Weitek's P9000 chip. Performance was almost equally excellent among the Advanced Integration Research Star2000 (\$475), American Megatrends FastView VLB (\$385), Cardinal WarpSpeed VL (\$599), and Diamond Stealth Pro VLB (\$499). They also support 24-bit color in 800-by-600 resolution (Appian's boards did not). Cardinal's WarpSpeed was awarded Editors' Choice on the basis of slightly better performance, fit and finish, and a fuller set of features.

MATROX

Another powerhouse company in this review was Matrox Electronic Systems, whose boards earned Editors' Choice awards for their 24-bit graphics capability. The Matrox MGA Ultima (\$899 for the VL-Bus version and \$849 for the ISA ver-

sion) had impressive Windows performance and delivered by far the best 24-bit color performance in Windows. These two boards were also among the few that supported 1,600-by-1,200 resolution.

Unfortunately, the Matrox boards

*Winstone is an
applications-based test
suite that employs
scripts running 12
popular Windows 3.1
software programs.*

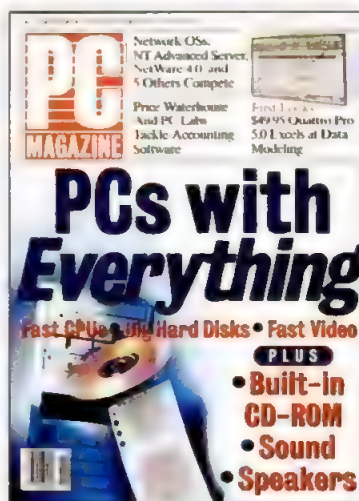
have their drawbacks—poor DOS and mediocre AutoCAD performance. In standard DOS applications, these two cards were the slowest we tested, while their AutoCAD results indicate that the company needs to do more work on its display-list drivers. These boards are

ideally suited for graphics applications. Matrox has announced plans to reduce their prices to \$599 by year's end, which will enhance their appeal.

TSENG AND ATI

A notch below the top performers were cards based on Tseng and ATI chips. Tseng Labs, the originator of the DOS VGA standard-bearer, the ET4000 chip, has finally made its presence felt in the GUI accelerator market with its 32-bit ET4000/W32i. The three graphics adapters based on this chip—the Focus 2 the Max TrueSpeed W32i, Micro-Labs Ultimate TrueColor/VL/XL2, and Sigma Designs Concorde VLB—proved to be among the most potent performers in particular categories, and for many users will offer compelling price/performance ratios.

The ET4000/W32i-based boards (all using the VL-Bus) garnered the top DOS scores of all the adapters. Furthermore, their graphics performance is close to the leading Windows scores. Even their AutoCAD results were good. The price range for these boards? From \$249 to



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The Macintosh Centris 660AV and Macintosh Quadra 840AV

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For the first time, use a Macintosh® to pick up phone messages with a point and click, record video by plugging in a



Apple AV Technologies.
Telecommunications, video, speech — all the ways you communicate.

video source, and open a file by saying, "Computer, open."

Many of these new functions are sped along by a digital signal processor (this chip flies through data at the rate of 55 MHz in the Macintosh Centris and an even faster 66 MHz in the Macintosh Quadra).

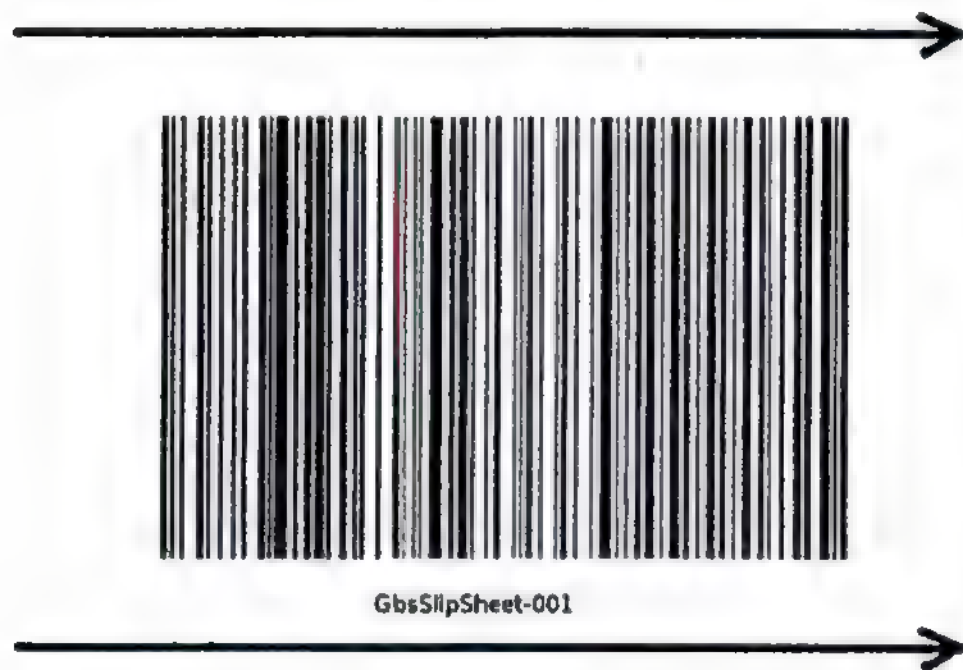
With a 25 MHz 68040 processor and up to 68MB of RAM, the Macintosh Centris has the horsepower required to breeze through huge spreadsheets and documents. And there's room to add a 500MB internal hard disk, a CD-ROM or SyQuest drive and a NuBus expansion card.

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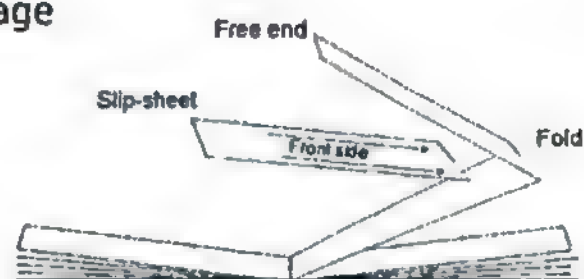


Inverted Foldout slip-sheet



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page

2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

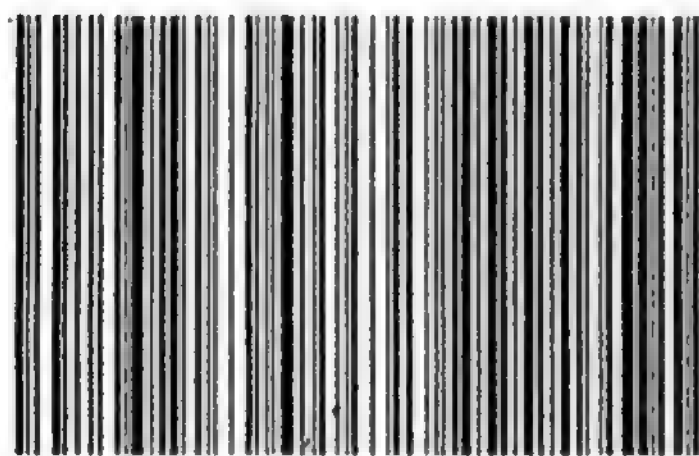
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlpBack-001B

Back

1. Follow instructions on the other side

In fact, they'll do just about

"Computer, call Michelle Dunn"

With Apple GeoPort, you can turn your AV computer (in this case, the Macintosh Centris 660av) into a telephone and an answering machine. The hands-free phone lets you do work on-screen while you talk. And both computers have ES-F2F software, so all you need is a video camera to hold a video-conference across a local area network.

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Forget the fax machine. The optional Apple GeoPort[™] Telecom Adaptor includes fax and modem software—everything you need to send and receive faxes from your desk or use on-line services. And both computers let you try out ExperFax, an application that converts your faxes into text.



GRAPHICS HARDWARE

2MB Video Boards

\$279. Expect street prices to be nearly irresistible at around \$200.

ATI Technologies, which has long been a leader in the video-acceleration game, has succumbed to competition from younger models. Of the three boards in this review founded on the ATI mach32 chip, only one—ATI's own VL-Bus version of the Graphics Ultra Pro—kept up with the Windows leaders. Its Graphics WinMark and Winstone scores placed this card among the front runners (which earned it an honorable mention). However, the ISA version of the Graphics Ultra Pro, as well as Elitigroup Computer Systems's ECS VI-605 VLB (which uses an earlier version of the mach32), trailed the others. Despite these results, scores for the mach32-based boards on our AutoCAD test matched or bettered those of its Windows rivals.

THE S3 FAMILY

Once among the speed leaders in the GUI accelerator market, S3's chips have been overtaken by newer designs. Graphics cards based on the P86C family of chips

made up the largest group in this review, with 13 entries. There was one S3 P86C801-based ISA board and there were three S3 P86C805-based VL-Bus adapters. The P86C805 is an updated version of the older P86C801 controller, incorporating a wider 32-bit external data path to support VL-Bus adapter designs. The other nine cards based on this chip family—five VL-Bus, three ISA, and one ISA/EISA convertible—were based on the top-of-the-line S3 P86C928 chip.

Software driver differences are especially apparent among the cards using chips from the S3 P86C family. Some vendors use the basic suite of drivers supplied by S3, while others soup up performance by supplying their own custom software—with varying results. In 800-by-600 mode with 256 colors on a 16MB system, for example, the P86C801-based entry surpassed the P86C805-based local-bus offerings, and even outperformed some more expensive P86C928-based boards in terms of their Graphics WinMark scores. On the other hand, in Winstone tests on 8MB systems, the P86C805 group outper-

formed the supposedly more powerful P86C928 crowd.

As a group, the S3 entrants ranged from below average to above average Windows performers. DOS scores ranged from excellent to low. Of note among the S3 boards are the \$299 Orchid Fahrenheit VA/VLB, which is the only video adapter here with built-in audio capabilities, and the \$599 ELSA Winner 1000VL, which led the entire 43-board field on our AutoCAD test. The P86C801-based Actix GraphicsEngine 32plus/2MB, at \$249 list, also produced respectable numbers.

CIRRUS LOGIC, IIT, AND COMPANY

The four VL-Bus boards based on the Cirrus Logic GD5428 chip, which are priced from \$169 to \$445, posted mediocre WinBench scores, good Winstone scores, and excellent DOS scores. Price-sensitive generalists who have to deal with a variety of applications in DOS and Windows should consider the \$169 Actix ProStar VL. It delivered excellent DOS performance, decent Graphics WinMark scores, and held its own on our

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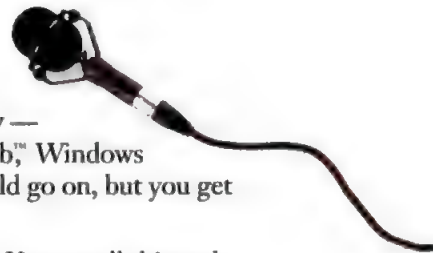
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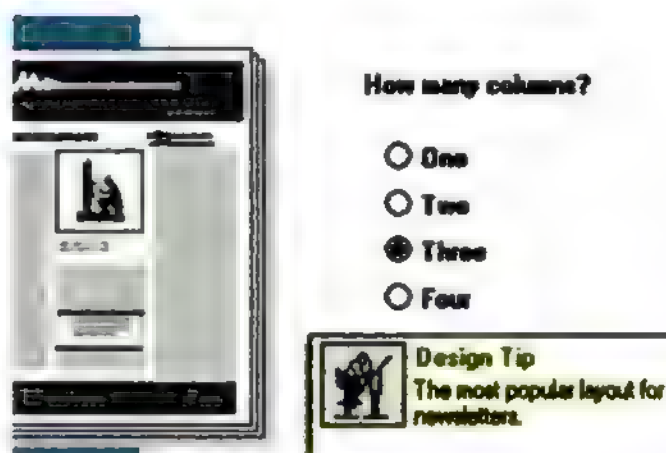


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Winstone tests. The ProStar AutoCAD drivers also proved sturdy, with an above-average 12.4 AutoCAD score.

Another chip vendor that had wide representation in this review was IIT. There were ten boards based on IIT's two chips, the AGX-014 and the more advanced AGX-015. Boards based on the AGX-014 produced DOS and Windows

scores that were generally underwhelming, while those based on the AGX-015 produced above-average Windows scores. The IIT controllers boast IBM XGA (Extended Graphics Array) compatibility. Because both older and newer IIT models are competing within the same price range (\$299 to \$625), shoppers should stick to the models with the newer AGX-015. The

standouts in the IIT group were the Hercules boards. ISA PC owners looking for 800-by-600 resolution with 24-bit color support should take note of the \$549 Hercules Graphite Pro.

One of two Western Digital Corp. entries proved a solid midrange Windows performer. The \$229 Western Digital Paradise Accelerator VL Plus is based on

• PCI Challenges the VL-Bus

by John R. Quain

Just when VL-Bus graphics adapters are proving their value, the Intel-specified Peripheral Component Interconnect (PCI) local-bus architecture is about to enter the field, bringing a new wave of video accelerators. This overview compares the PCI-bus and VL-Bus technologies, and provides test results of four of the first PCI-bus graphics cards available—prototypes from ATI Technologies, Diamond Computer Systems, ELSA America, and STB Systems. The PCI-bus cards performed well but didn't show any clear-cut advantages over VL-Bus cards in terms of video performance.

At first glance, the various benefits and drawbacks of Intel's PCI bus architecture closely match those of the VESA (Video Electronics Standards Association) VL-Bus, especially in terms of graphics performance. Both VESA and Intel claim a data throughput of about 132 megabytes per second for boards connected to the new buses—far greater than ISA's practical performance limit of 1.5 to 3 MBps. The additional bandwidth that these advanced bus architectures provide will benefit high-end graphics and multimedia applications. However, many users will need to buy a new PC or motherboard to take advantage of the VL-Bus or PCI.

The advantage of the PCI scheme is not merely to provide faster video performance, but also to let peripherals on the PCI bus operate asynchronously. That is, the CPU can send out instruc-

tions and access system memory without waiting for peripherals to respond. So even though PCI add-in cards may not run video faster than VL-Bus cards can, they won't keep the CPU waiting.

The differences between the VL-Bus and PCI center on the way the peripherals achieve their performance gains.

*PCI cards performed well
but, in terms of video
performance, didn't show
any clear-cut advantage
over VL-Bus.*

The VL-Bus approach gives up to three peripherals 32-bit access to a 486's local system bus running at the CPU's clock speed. Intel's PCI is designed to handle up to ten loads (a peripheral device may have two loads) on a 33-MHz CPU-to-local-bus bridge design using FIFO (first in, first out) buffers. Hence, Intel refers to its architecture as an intermediate local bus. Intel also built 64-bit local-bus access into the PCI specification, a nod toward the company's Pentium CPU.

So far, the main drawback of the VL-Bus is that this bus is synchronous with the processor. Because most peripherals run considerably slower than a 486 or Pentium processor, wait states are often introduced, leaving the CPU waiting until slower local-bus expansion cards finish their work.

According to VESA, however, the forthcoming revised VL-Bus specification includes 64-bit access and an asynchronous "mezzanine" bus with many of the capabilities of PCI. Future VL-Bus machines may offer many of the touted features of PCI.

One additional factor that may help PCI overtake the VL-Bus is PCI's processor independence. PCI's intermediate bus uncouples the CPU from the rest of the system so that motherboards need not be redesigned every time a new microprocessor is introduced. This processor independence has resulted in Apple Computer's proposed support of the PCI bus on its Power PC-based machines. Likewise, Digital Equipment Corp. has announced support for PCI on its Alpha-based PCs.

With these issues in mind, PC Magazine Labs tested four prerelease PCI graphics accelerators on an Intel PCI 2.0 reference PC. The test-bed 486DX2/66 had 8MB of RAM and three PCI expansion slots (PCI is expected to shine in Pentium-based PCs). Most of the Winstone and Graphics WinMark results for the PCI boards were similar to results achieved with similarly configured VL-Bus cards.

For example, the PCI version of the Diamond Viper achieved a Graphics WinMark score of 14.6 million pixels per second in 800-by-600 mode with 256 colors, while the VL-Bus Diamond Viper VLB posted a Graphics WinMark score of 14.5 million pixels per second. On the other hand, some PCI board scores were 5 to 10 percent

the company's own WD 90C33 controller (the Western Digital Paradise Accelerator Pro uses an IIT AGX-014 controller). Western Digital has done a respectable job boosting Windows performance with this model. The card's weak spot was its low AutoCAD score.

The most expensive entry in the roundup, the \$995 Nth Edge 1280, is also

better than those of their VL-Bus counterparts. For example, ELSA America's PCI card scored 10.5 million pixels per second, while the VL-Bus version scored 9.3 million pixels per second.

Although some of the results are in line with Intel's expectation that PCI cards will show a 5 to 10 percent performance boost over VL-Bus adapters, making such a direct comparison between the two systems is difficult. One reason is the different system-control logic used in the Intel 486 reference PC. The control logic, or chip set, manages such crucial elements as the external memory cache, and this can significantly affect a CPU's performance, in turn affecting the system performance—including graphics speed.

More important, the PCI specification requires more chip-level redesigns for connected peripherals than does the VL-Bus architecture. One goal of PCI is to eliminate much of the glue logic typically required on expansion boards. One consequence of removing the glue logic is that peripherals must feed back more configuration information to the CPU.

Furthermore, PCI uses a technique called multiplexing, which lets more than one signal carry over a single electrical path. These innovations let graphics-controller chips use fewer pins, thus lowering the cost of manufacturing. But it also means that to tap the full potential of the PCI architecture, chip-level changes need to be made, and the PCI graphics accelerators PC Labs tested are based on earlier designs that were based on ISA or VL-Bus requirements. □

the slowest Windows performer, a reminder that not all graphics work is conducted under Microsoft's GUI. The Edge 1280 is based on the C&T F82C481 graphics controller, which is designed to support IBM's all-but-forgotten 8514/A graphics standard. Because the Edge 1280 isn't intended for Windows users, it is not a Windows user's best buy.

FEATURES

Sheer pixel speed is nice, but there are several other features you should consider when assessing video cards. Quickly becoming standard items on these boards are full-fledged Windows utilities, such as Hercules' screen alignment and sizing applets, and Number Nine's control panel that lets you change the color of the cursor. Higher color support, virtual screens, and pan-and-zoom features also are becoming increasingly common.

Many vendors provide near-on-the-fly mode switching as well. Mode switching lets you change resolution and refresh rates without entering Windows' Setup. However, very few GUI accelerators let you change modes without restarting Windows (most let you restart with a mouse click).

While most of the video adapters in this review are able to handle 256 colors in 800-by-600 and 1,024-by-768 modes with equal aplomb, few do as well working with 24-bit color. Of the 43 boards tested, only 22 of them can put 16.7 million photo-realistic colors on your screen in Super VGA. Because of the enormous amount of information the boards must process, expect performance to drop by 50 to 90 percent in true-color mode.

Virtual-screen and pan-and-zoom features were once exclusive to video adapters priced around \$3,000, but today more and more midrange graphics cards support these features. If you like to keep as many windows open as possible or perform a lot

of desktop publishing, you'll appreciate a virtual screen. Although it only displays one 800-by-600-pixel area on your monitor at a time, the virtual-screen feature stores additional unseen portions of a much larger overall display in memory. By moving your mouse, you move to different "virtual" areas of the larger image, giving you the equivalent of, say, 1,600 by 1,200 pixels or two 11-by-17-inch pages. Pan-and-zoom features use similar techniques to focus on particular areas of graphics.

Users of training and presentation applications should consider the P86C928-based Metheus ISA boards. Up to four Metheus graphics adapters can be plugged into a single PC without raising conflicts, thus letting several monitors connect to a PC.

Key developments to watch for include video-board support for VESA's Display Power Management Signaling specifications (which will enable monitors to conform to Energy Star energy-saving requirements) and new multimedia graphics cards that combine motion video, sound, and graphics controllers on one board.

► AGC 98032-BASED CARDS



Appian Renegade 1280/I

Appian Renegade 1280/V

BY JAMES KARNEY

If you're looking for speed and don't need true color beyond 640-by-480 resolution, the Appian Renegade 1280 series may steal your heart. These two Editors' Choices—one ISA and one VL-Bus product—are powered by Appian Technology's newly developed AGC 98032 32-bit engine. The \$425 Appian Renegade 1280/V came in first on most of our tests, slightly ahead of the boards based on the Weitek P9000 chip. These two boards are strong contenders for Microsoft Windows users with mainstream graphics requirements.

Both Renegade boards' Winstone scores on our 8MB and 16MB test-beds led the pack for their respective bus categories. On these tests, the \$485 Appian Renegade 1280/I's 53.9 Winstone score on our PC with 16MB of RAM beat those of all the VL-Bus boards except its brother's. The Renegade 1280/V had the top Winstone score and WinBench scores (in 1,024-by-768 and 1,280-by-1,024 mode

Our Contributors: BRUCE

BROWN and JOHN R. QUAIN are contributing editors to *PC Magazine*. JAMES KARNEY is a frequent contributor to *PC Magazine*. BRADLEY G. EPRANIAN is a benchmark developer at Ziff-Davis Benchmark Operation. MICHAEL NEUBARTH was the associate editor in charge of this story, and JONATHAN HILL was the project leader.

with 256 colors). In 800-by-600 mode with 256 colors, its Graphics WinMark score came in a marginal second to two boards based on the P9000 chip (15.8 million pixels per second versus 15.4 million).

The only significant performance advantage the Weitek and Matrox boards had over the Appian cards was their ability to support 24-bit color at 800-by-600 resolution.

The Appian Renegade boards only support 24-bit color in 640-by-480 resolution.

Appian claims its next version of the Renegade series will support 800-by-600 with 16.7 million colors. EISA versions also are slated for release by year's end.

For CAD users who need a dual-display system, the Renegade boards can drive two monitors at the same time. On the back of the cards are two monitor ports. One is connected to the AGC 98032's circuits and uses a TI ViewPoint TVP 3010 RAMDAC with 2MB of VRAM. It handles all the accelerated functions plus high-resolution and color modes. The second connection is for an on-board VESA-compatible Cirrus Logic VGA controller, which has its own 512K of DRAM. In effect, there are two graphics systems on one adapter.

The AGC 98032 provides a hardware cursor, and also a virtual screen with pan-and-zoom functions. Installation was straightforward. There are no IRQ settings required, because the card is I/O-based. You load a device driver that configures the location of the 16K address space, which can be placed anywhere in the first 1MB of system memory. You use an Appian control panel to change modes under Windows, but you must exit and reload before the new settings can take effect. In addition to Windows 3.1 drivers, Appian provides ADI 4.2, AutoShade, MicroStation, 3-D Studio, and 8514/A AI emulations.

While Appian may not be a well-known name, it does have a notable past, since it is the resulting merger of Renaissance GRX (once known for high-end graphics boards) and ZyMOS Corp. The Renegade boards are a fine first offering. They boast an excellent design and a powerful engine, which proved itself on our tests. Appian and its products are worthy of your attention. The boards' feature set and documentation were also excellent.

► ATI MACH32-BASED CARDS

ATI Graphics Ultra Pro ISA ATI Graphics Ultra Pro VLB ECS VI-605 VLB

BY JAMES KARNEY

ATI Technologies has long been known for feature-packed graphics adapters with better-than-average performance. In fact, the company's products have won their share of awards, including our Editors' Choice distinction. Three boards using the ATI mach32 engine are included in this roundup. Two are ATI's own—the ATI Graphics Ultra Pro ISA and the ATI Graphics Ultra Pro VLB. The third is Elitegroup Computer Systems' ECS VI-605 VLB. The results were varied, with the ATI VL-Bus card providing the most bang for the buck.

The three cards spanned the range in terms of performance on our tests. The Graphics Ultra Pro VLB had the eighth-best Winstone score (53.0) on our 16MB test-bed—quite close to the leaders' marks. But the Graphics Ultra Pro ISA and the VI-605 had the two worst scores (47.0 and 45.4, respectively).

Their Graphics WinMark results were similar. ATI's VL-Bus version placed seventh, with a score of 13.2 million pixels per second, while the other two cards remained in the basement, with scores of 5.7 million and 4.2 million, respectively. Their AutoCAD performance was better. The Graphics Ultra Pro ISA was second, with a score of 13.6. The VLB version was fifth, with a score of 13.3, and the VI-605 VLB placed thirtieth, with a score of 11.4. The Elitegroup board could not match the performance or features of the ATI cards. It uses an older version of the ATI chip. It also lacks the extra documentation and mouse port of the Graphics Ultra Pro ISA.

All three cards offer zero-wait-state VGA operations and 24-bit 800-by-600 operation if equipped with the ATI68875 RAMDAC. Drivers are supplied for

AutoCAD, GEM, Lotus 1-2-3, Microsoft Windows 3.1, OS/2, WordPerfect, and several other DOS applications. All three cards use the basic manual provided by ATI, which is well written and organized. The two ATI cards also come with another set of documents, covering additional drivers for Video for Windows compression and acceleration. This driver set provides hardware-assisted image scaling using StretchBlts.

Installing the cards was easy, and we did not have to change any jumper settings.

Some users might have to modify the settings to avoid a COM-port conflict. The mach32 supports the IBM 8514/A standard and uses the same default addresses. There is a VGA pass-through connector for dual adapter/display operation. If you already have a mouse attached to your computer, you probably won't need the one that comes with the adap-

ter. The ATI card provides its own mouse port, freeing your computer's serial port. The mouse is Microsoft mouse-compatible and sports 400-dot-per-inch resolution.

Once the card is up and running, the ATI FlexDesk lets you change the color depth, resolution, and font handling. To make any changes, you will have to exit and restart Windows. ATI also supplies its Crystal Font anti-aliasing technology, which reduces jagged edges on screen fonts under Windows. ATI backs its cards with a full five-year warranty, an indication of the company's confidence in the cards' basic design. These ATI-based cards may not have performed as well as those in past roundups, but the list of features and range of drivers make them attractive.

*The message is clear.
If you want top
graphics performance,
it's time to
switch to an
advanced-bus PC.*

► C&T F82C481-BASED CARDS

Nth Edge 1280

BY JAMES KARNEY

For this review, the \$995 Nth Edge 1280 was the sole card based on the C&T F82C481 engine, which emulates the IBM 8514/A graphics standard. The board is not aimed at Microsoft Windows power users, but rather at individuals who spend

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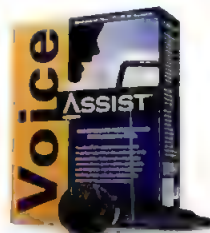
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Benchmark Tests: 2MB Video Boards

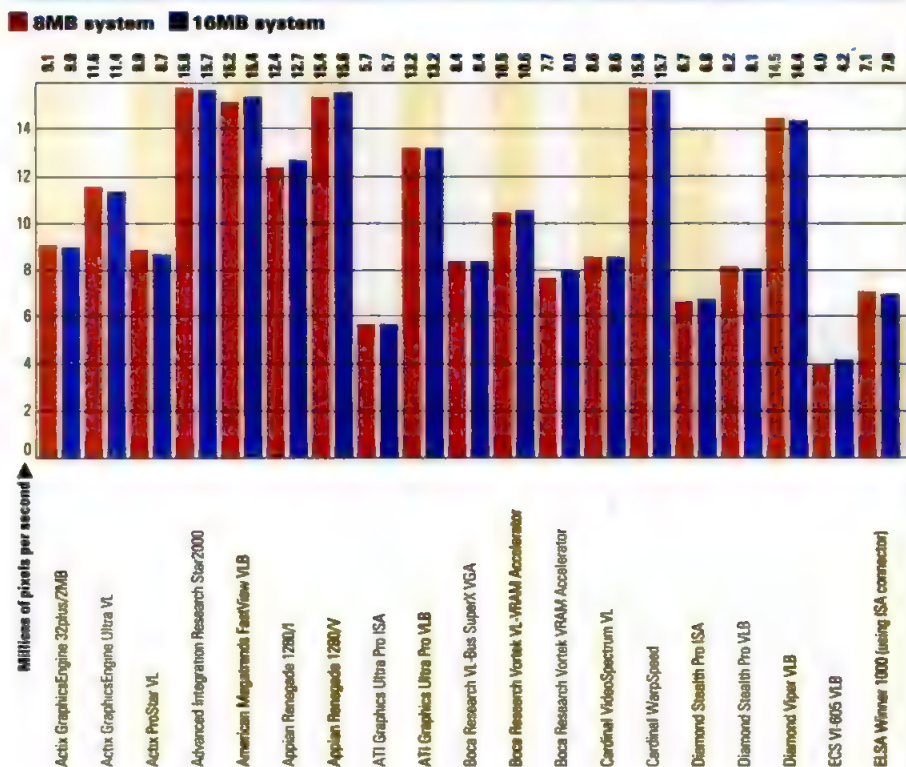
What the Numbers Mean

We tested the graphics accelerator cards in this issue by using the latest versions of our suite of benchmark tests, including PC Bench 8.0, WinBench 4.0, and Winstone 94, Version 1.0. The AutoCAD results are based on the San Diego ACAD Users Group's 3-D Mechanical performance tests. We used Micron 486VL machines for our test-beds because they use upgradable Micronics EISA/VL motherboards. Each was configured with a 486DX2/66 processor, 8MB or 16MB of RAM, a 256K RAM cache, and a 153MB hard disk.

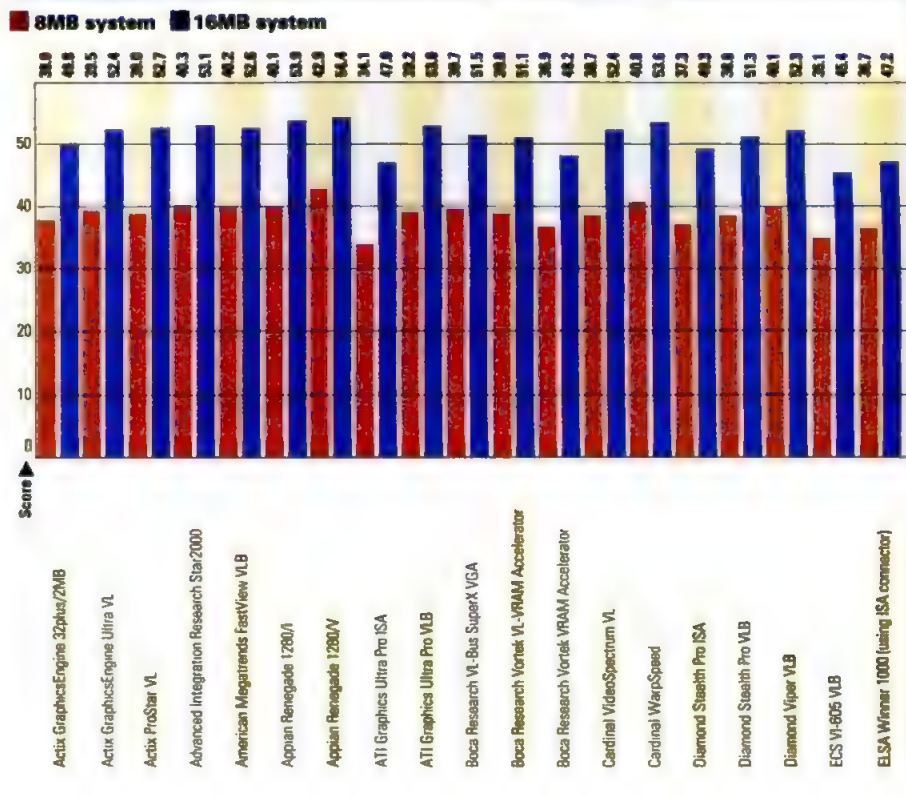
WinBench 4.0 is a complete revision of our Windows Benchmark tests. We report the Graphics WinMark scores for four combinations of resolution and color depth: 800-by-600 with 256 colors (72 Hz), 1,024-by-768 with 256 colors (70 Hz), 1,280-by-1,024 with 256 colors, and 800-by-600 with 16.7 million colors (the last two at each board's highest refresh rate). To gauge the effect of increased system memory (16MB versus 8MB), we increased the RAM to 16MB and reran WinBench 4.0 at 800-by-600 with 256 colors.

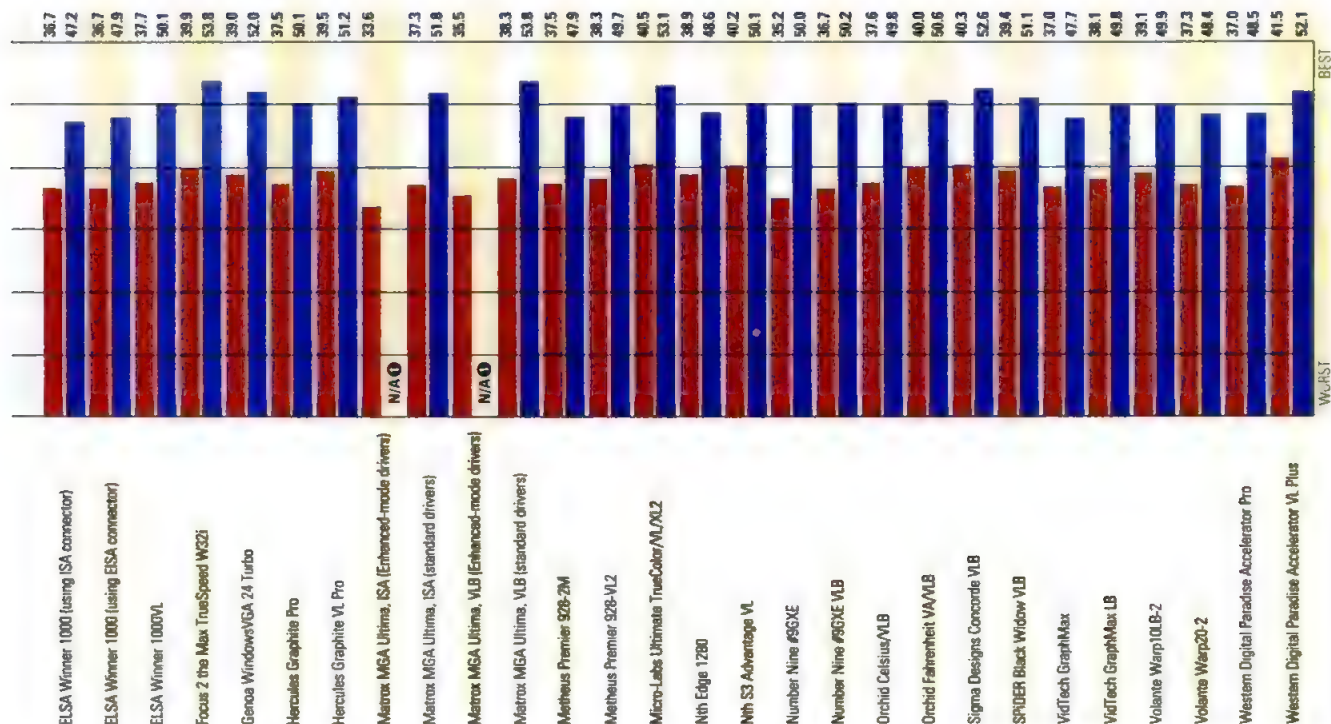
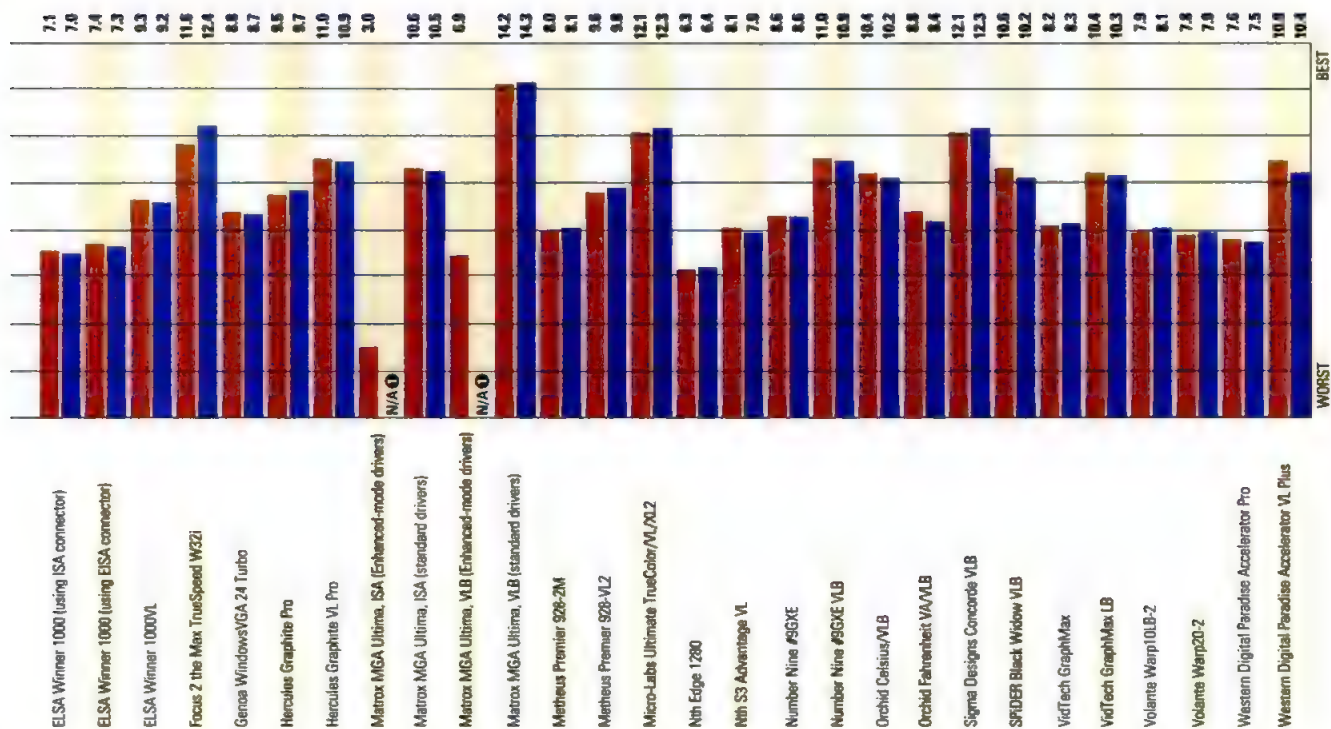
Winstone 94, Version 1.0, is a new application-based benchmark test that measures system performance under Windows 3.1. We tested each graphics accelerator at 800-by-600 with 256 colors, alternately using 8MB and 16MB of system RAM. Because all other variables remained constant for the duration of this study, information gleaned from the Winstone results can be used to assess the impact of the graphics subsystem on performance. In contrast with the Graphics WinMark results, which are nearly unaffected by changing the amount of system RAM, the Winstone results are strongly affected by the amount of available memory. Thus, the WinBench results tend to isolate the graphics subsystem, while the Winstone results indicate the efficacy of the graphics subsystem's interaction with other subsystems (such as the

Graphics Winmark (800 x 600, 256 colors)



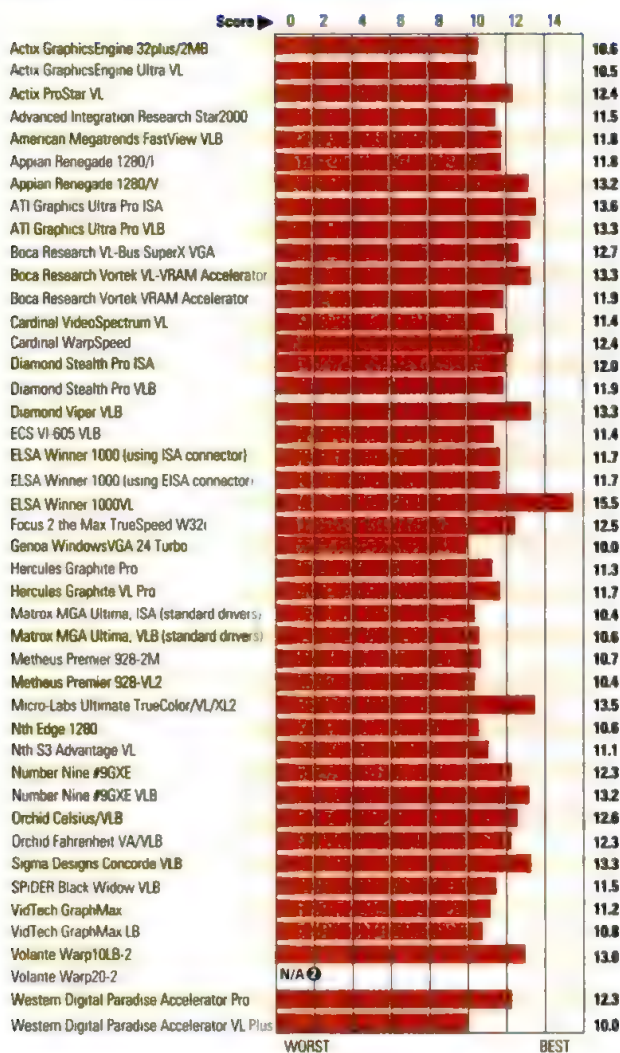
Winstone





N/A — Not applicable. We did not run the test on this product.

AutoCAD



N/A ① —Not applicable. The Volante Warp20-2 could not complete this test.

N/A ② —Not applicable. The Nth Edge 1280 does not have an on-board VGA chip.

processor, memory, and disk subsystems). For detailed descriptions of our Winstone tests, and the changes and improvements in our other Windows tests, see the Lab Notes section in this issue.

To help define the best performance parameters for mainstream Windows 3.1 users, we used a scatter chart to plot the Graphics WinMark results against the Winstone results for the 16MB systems. We ran these tests at 800-by-600 resolution, using 256 (8-bit) colors and a vertical refresh rate of 72 Hz.

Boards in the upper-right corner of the chart performed well on both tests. The performance leader was the Appian Renegade 1280/V. This card, based on Appian's AGC 98032 Graphics Engine, was a clear winner on our Winstone tests, and effectively tied with two Weitek P9000-based boards—the Cardinal WarpSpeed and the Advanced

Video

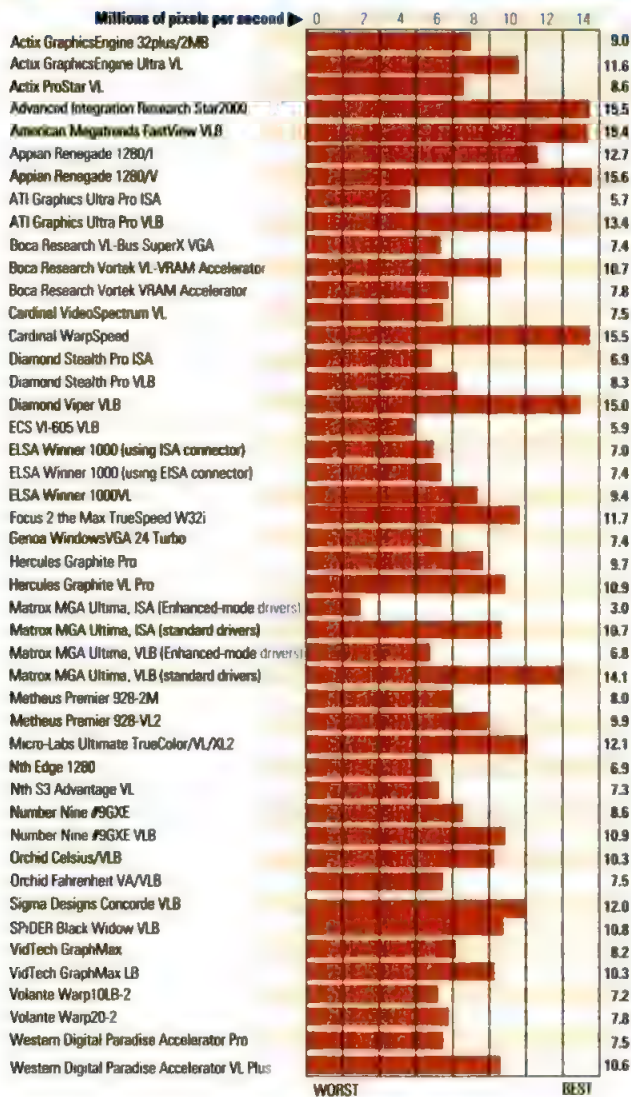


Integration Research Star2000—for top honors in terms of WinBench performance. Appian's ISA solution, the Appian Renegade 1280/I, also performed exceptionally well. The other boards based on the Weitek P9000 chip—the American Megatrends FastView VLB and the Diamond Viper VLB—turned in better-than-average results (ranking eleventh and fourteenth, respectively, on Winstone), despite the P9000's general underperformance on our Winstone test compared with our theoretical model.

Other boards with exceptional performance at 800-by-600 with 256 colors were the Matrox MGA Ultima (both the ISA and VLB versions), the ATI Graphics Ultra Pro VLB, and three boards based on the Tseng ET4000/W32i chip: the Focus 2 the Max TrueSpeed W32i, Micro-Labs Ultimate TrueColor/VL/XL2, and Sigma Designs Concorde VLB.

If you intend to do much true-color work, you will be

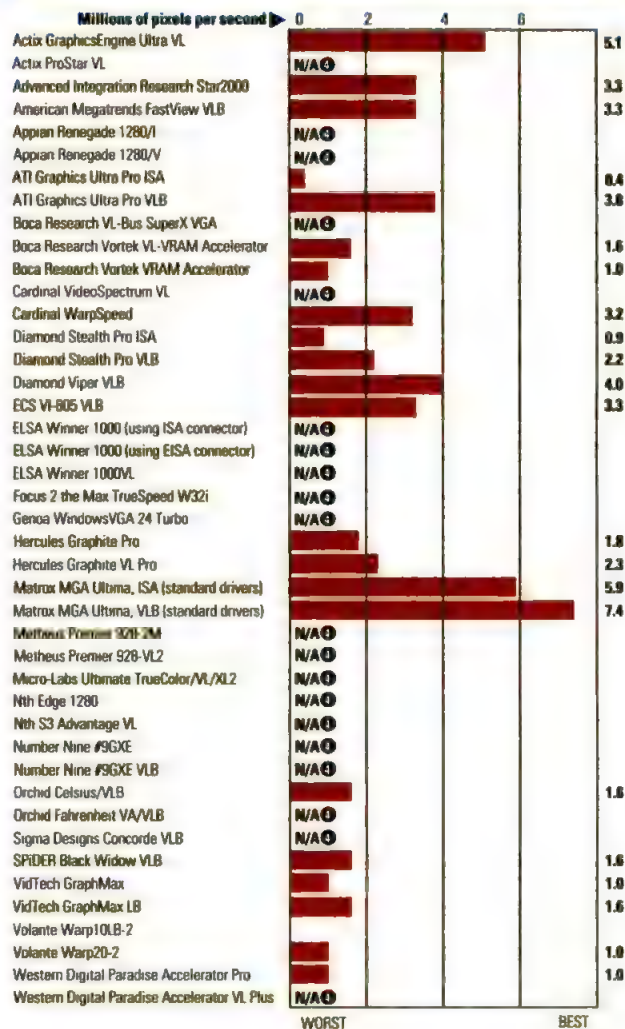
Graphics WinMark (1,024 x 768, 256 colors)



particularly interested in the two Matrox cards and the 86C928-based Actix GraphicsEngine Ultra VL. Bucking all trends, at 24 bits the ISA version of the Matrox MGA Ultima outperformed all of the VL-Bus cards in this review except its VL-Bus counterpart, producing a second-place Graphics WinMark score at 800-by-600 with 16.7 million colors. Its score of 5.9 million pixels per second was significantly faster than that of the third-place GraphicsEngine 32plus. By an even wider margin, the VLB version of the Matrox MGA Ultima was the number-one true-color card in this review.

Other boards that performed relatively well in 24-bit color include the ATI Graphics Ultra Pro VLB and Diamond Viper VLB, followed by the rest of the Weitek P9000-based cards and, surprisingly, the ECS VI-605 VLB. Performance for the rest of the boards that support 24-bit

Graphics WinMark (800 x 600, 16.7 million colors)



N/A — Not applicable: The product does not support this resolution at this color depth

modes falls off rapidly. If you spend much time working in true color, you will likely be frustrated by their slowness.

While a high color depth clearly hurts adapter performance, high resolution has little effect. Most of these boards can draw at the same speed over a range of resolutions. Be sure the boards you're considering support all the resolutions you need, but don't expect any individual card to vary much in performance across the bulk of those resolutions.

A few adapters did show significant performance differences at higher resolutions. The GraphicsEngine 32plus dropped off in performance at 1,280-by-1,024. Five boards—the Boca Research VL-Bus SuperX VGA, Cardinal VideoSpectrum VL, Genoa WindowsVGA 24 Turbo, Orchid Fahrenheit VA/VLB, and Volante Warp10LB-2—showed noticeable though not huge performance decreases at resolutions above 800-by-600. Note that

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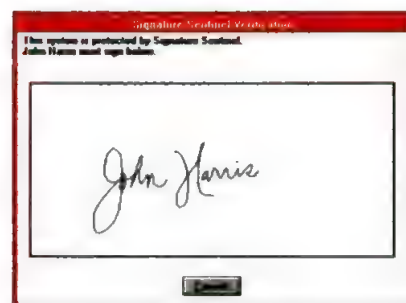


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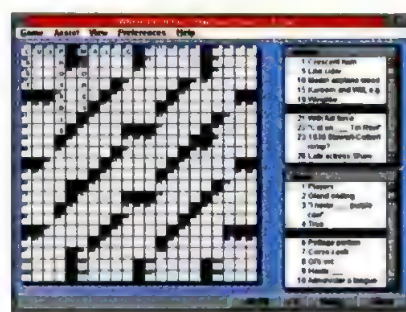
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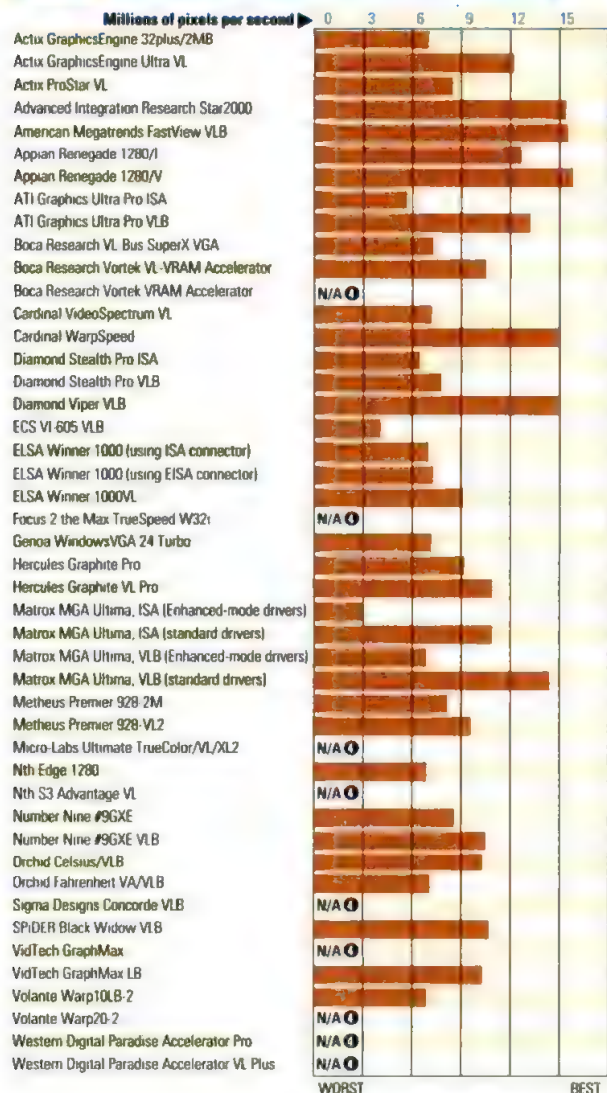
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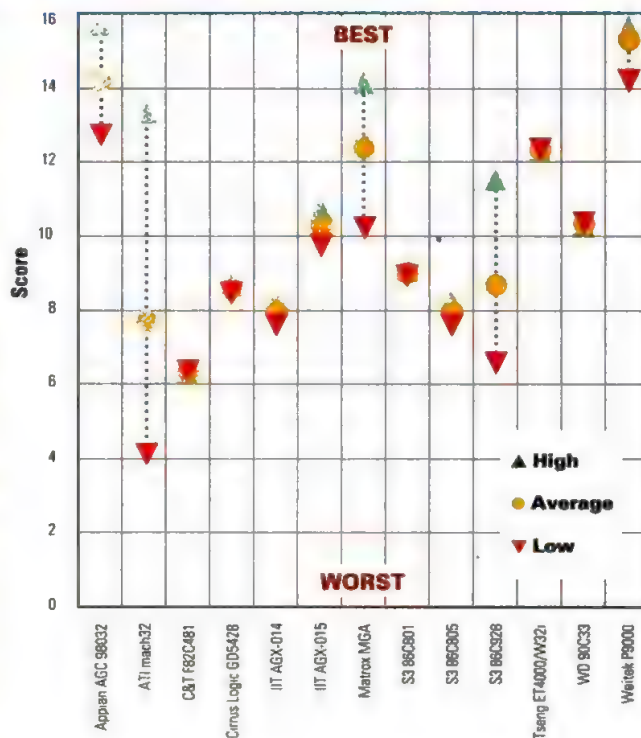
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*Voted #1 at PenExpo January 1993 and PenExpo September 1993. **This \$199 (US) offer is valid only in the U.S. and Canada. Return privilege is 30-days provided the product is in resalable condition. For pricing information outside the U.S. and Canada, call (415) 802-7888. After December 31, 1993, Handwriter will be \$399. Handwriter and Dynamic Signature Verification are registered trademarks of Communication Intelligence Corporation. Windows is a registered trademark of Microsoft Corporation. All other names or products are trademarks or registered trademarks of their respective companies.

Graphics WinMark (1,280 x 1,024, 256 colors)



Graphics WinMark Performance by Chip Type



N/A —Not applicable. The product does not support this resolution at this color depth

Apparently, S3 completed a major revision of its graphics drivers just prior to the start of our testing. Some of the computer vendors managed to create customized drivers based on this latest release; other vendors' drivers were still under development when we began testing. Check the vendors' BBSs for the latest drivers for their 86C928-based products (do not call S3). By the time you read this, most if not all of the vendors should have completed their driver customizations.

The variation in the 86C928-based boards' performance, which is due to driver revisions, leads to a very general conclusion: If you are unsatisfied with the performance of your current graphics adapter, consult the vendor's BBS to make sure that you're using the very latest drivers. In many cases, you can experience significant performance boosts by updating your driver set. ATI, for example, had recently released updated drivers for nearly their entire product line—including older models like the VGA Wonder and Ultra+.

One last point about software drivers: The combination of major revisions in WinBench and the use of 12 major applications in Winstone has proven to be an incredible engine for unearthing bugs in the drivers. Many of the boards went through several driver revisions in order to complete our tests. As a result, the latest drivers have significantly fewer bugs and are generally much stabler—yet another reason to check your vendor's BBS.

all of these boards use standard DRAM designs.

Take a close look at the scatter chart: You can almost always predict how well a board will perform by knowing what chip the board uses. The obvious exception is the group of cards based on the S3 86C928 chip. The results for these cards varied widely: Graphics WinMark scores ranged from 6.8 to 11.4 million pixels per second, and the range of Winstone results is almost as large.

After retesting these cards, we contacted S3 for an explanation of the results. S3 sent us a copy of the reference drivers that they supply to their licensees, and we retested all of the S3 chip-based boards (including the 86C805-, 86C801-, and 86C928-based products). The results were striking: All of the 86C928-based VLB cards achieved Graphics WinMark scores from 11.1 million pixels per second. The 86C928-based ISA cards scored from 9.3 million.



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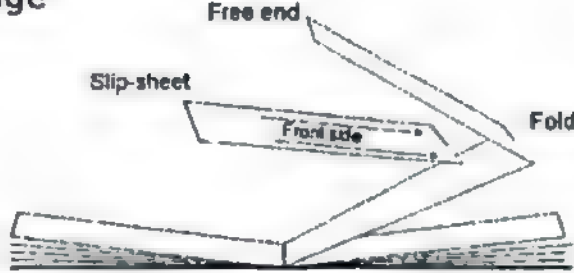
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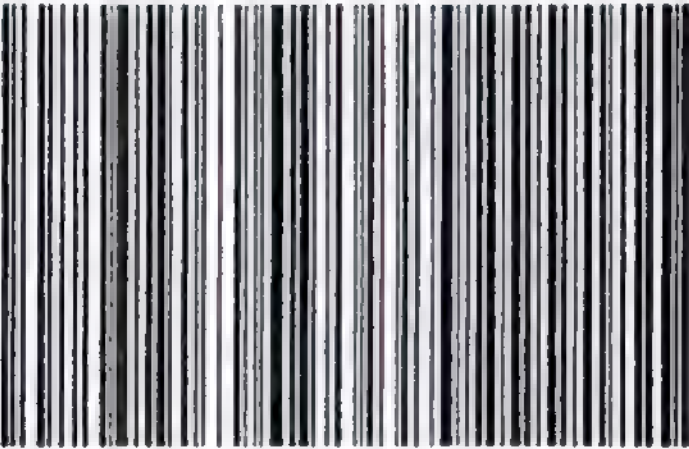
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Folded edge of the page



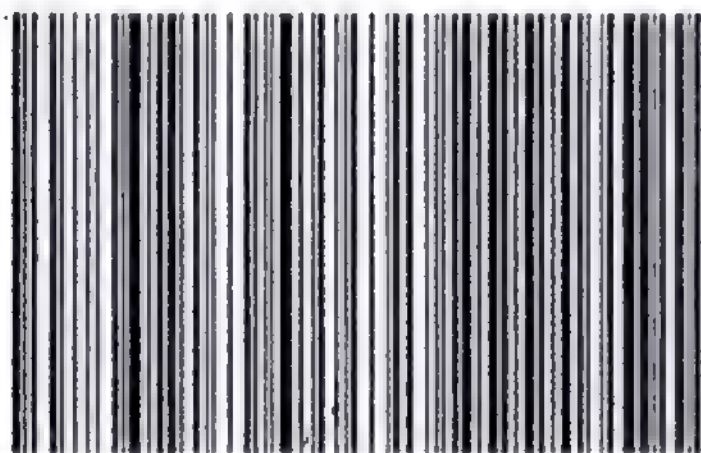
Inverted Foldout slip-sheet



Folded edge of the page

1. Follow instructions on the other side

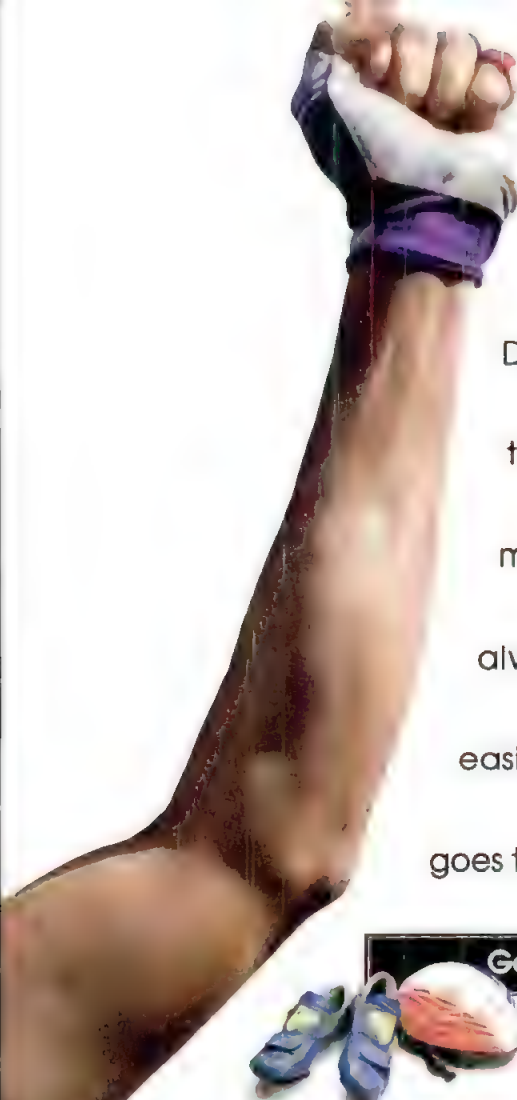
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GbsSlipBack-0018

Back

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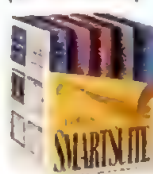
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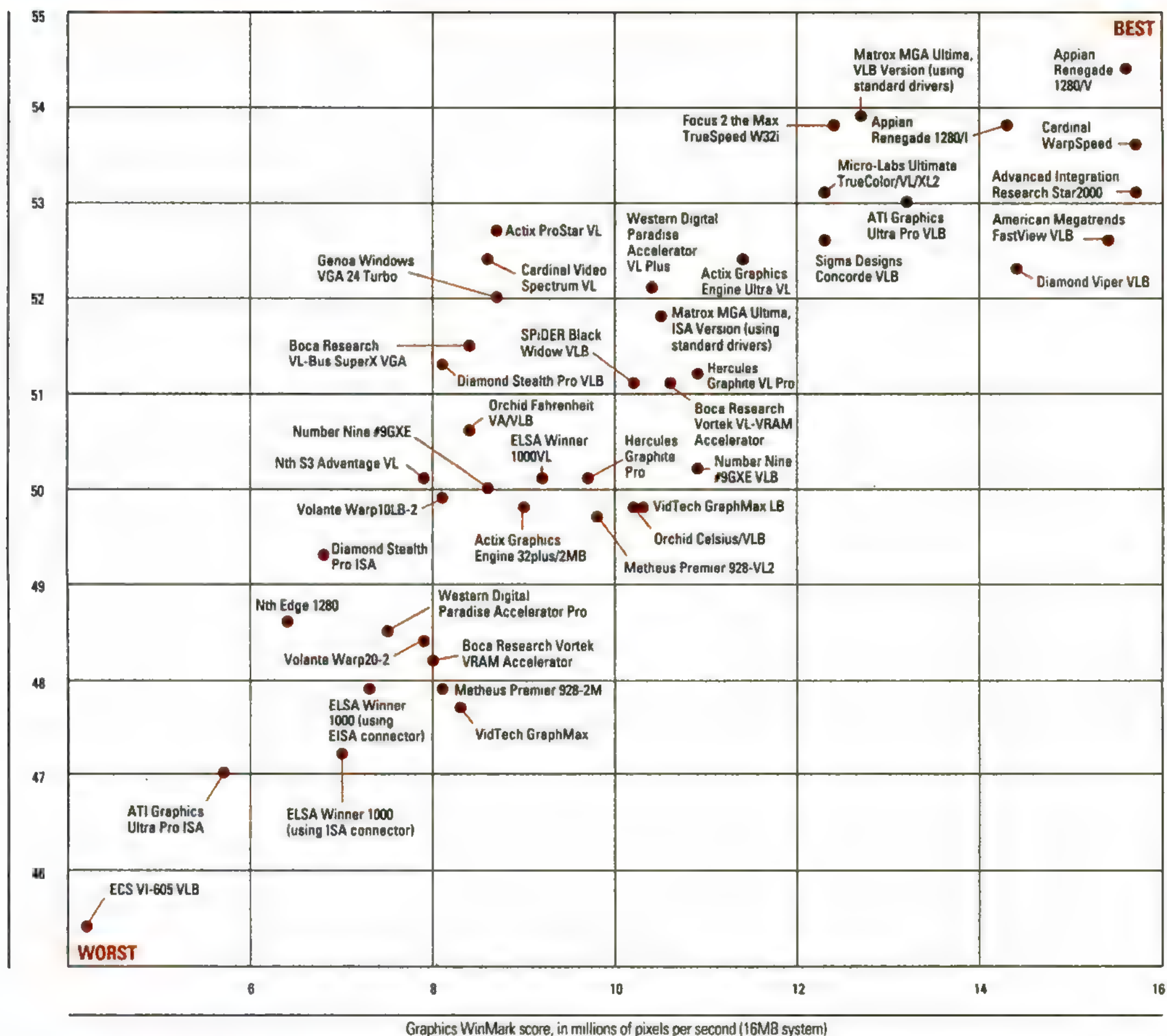
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How We Tested

The **AutoCAD** test was developed by Chris DeLucci and the AutoCAD Users Group of San Diego. We ran the 3-D mechanical tasks in Version 2.0, which reports elapsed times for 18 CAD operations, including hidden-line removal, shading, pans, zooms, redraws, regenerations, and random vector generation. We normalized each result against that of the worst performer in the roundup; for each product, we report an adjusted harmonic mean derived from the individual scores.

The **DOS video** score is a weighted harmonic mean of tests that measure 8- and 16-bit VGA write operations involving both text and graphics.

The **Graphics WinMark** score is a measure of PC graphics performance under Windows 3.1. We run 66 different tests—divided into seven graphics test mixes—to evaluate a PC's handling of the Windows GDI (Graphics

Device Interface). These tests are based on extensive application profiling. The scores are reported in millions of pixels per second.

Winstone 94, Version 1.0, measures the time a PC takes to execute a set of application scripts that exercise 12 of the best-selling Windows 3.1 applications.

Winstone 94 uses the individual script execution times and the unit market shares of the applications to compute each product's score. Winstone scores have been normalized relative to a Compaq Deskpro 386/25M with 4MB of RAM, which has a Winstone score of 10.0.

As with the other tests, higher scores represent better performance. Specifically, a PC with a score of 20.0 will deliver twice the performance of the reference machine when running typical Windows 3.1 applications.

most of the day working in CAD applications on dual monitors. That has been the traditional market for Nth Graphics. The Edge 1280 scored near the bottom of the pack in terms of its WinBench and AutoCAD performance; it produced decent Winstone scores. Although it is

*The all-around leaders
in this review were
boards based on three
chip types: the Appian
AGC98032, Matrox
MGA, and Weitek P9000.*

equipped with 2MB of VRAM, several boards with DRAM outran it.

The Edge 1280 does offer faster performance and a resolution higher than VGA and 8514/A, and even standard XGA. But given its high price and benchmark test results that are low in

comparison with the current crop of Windows adapters, you cannot consider it a good buy. Its most likely buyer is someone with an expensive but aging single-frequency monitor he or she doesn't want to replace. We tested an ISA version of the card; a similar Micro Channel architecture (MCA) version is also available.

Installing the card will require a bit more work than for those offering on-board VGA. You will need a second graphics adapter attached to its pass-through connector to handle DOS operations and any application without an 8514/A or special Nth Graphics driver. Bundled software includes AutoCAD, AutoDesk, Microsoft Windows 3.1, MicroStation, and VersaCAD.

The Nth Graphics AutoCAD driver does offer icon support, fast zooms, and customization features. During our testing, all the drivers worked without any problems and were easy to install, but the manuals could have been a bit clearer. The only utilities include an installation routine and a diagnostics program. The

company offers toll-free support and free bug fixes for 90 days after purchase.

For general Windows use, there are many cards that offer better performance at less than half the price of the Edge 1280.

► **CIRRUS LOGIC GD5428-BASED CARDS**

Actix ProStar VL

Boca Research VL-Bus

SuperX VGA

Cardinal VideoSpectrum VL

Genoa WindowsVGA 24 Turbo

BY BRADLEY EPRANIAN

If you're looking for a low-cost graphics accelerator that provides fast DOS and Microsoft Windows performance for general-purpose applications, boards based on the Cirrus Logic GD5428 chip may be the answer. For image processing and other graphically intensive applications, you should consider boards

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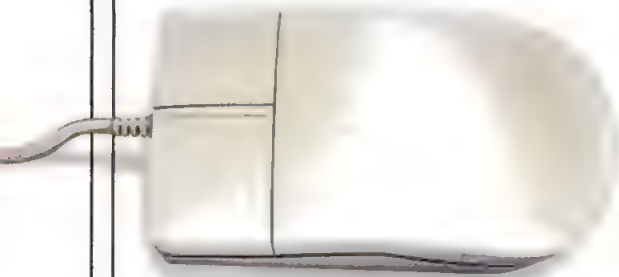
need retraining and new hardware? When will their product be available? A year from now? Two? Can you wait that long? Furthermore, have their systems been thoroughly tested?

Some accounting
tempt you with
can be very

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that are better suited for a heavier workload.

The Actix ProStar VL is a steal at \$169 (list), providing good Windows application performance and the same basic features (such as installation software and utilities) offered by all of the reviewed boards based on the Cirrus Logic GD5428. The Cardinal VideoSpectrum VL, which lists for \$199, had slightly weaker performance than the other boards in this category. The higher-priced Genoa WindowsVGA 24 Turbo (\$289 list) provided higher refresh rates and came with better installation software and utilities than the other Cirrus Logic cards. The Boca Research VL-Bus SuperX VGA, which was the most expensive card in this category (\$445 list), offered no discernible performance or features benefits to justify its higher price.

All of the Cirrus Logic boards we tested are local-bus cards that support a maximum of 64,000 colors in Super VGA. None of them, however, support 24-bit true-color graphics.

PERFORMANCE AND WHAT IT MEANS

The boards using the GD5428 all performed above average on our Winstone test. In 800-by-600 mode with 256 colors, they scored near the top, with an average Winstone score of 52 with 16MB of RAM. The ProStar had the highest Winstone scores among the GD5428-based video processors, and was among the top-ten overall on this test.

In contrast, these same boards all scored below average on our WinBench test. This difference can best be explained by examining the differences between the two tests. WinBench issues many more Windows API calls per second than does Winstone. WinBench's Graphic WinMark exercises the API using a wide range of graphics calls with a large distribution of parameters. WinBench also utilizes dithering, which tests a board's color range more intensively.

We believe the difference between the Cirrus Logic cards' WinBench and Winstone results is due to the boards' design. The GD5428-based video cards in this roundup all use DRAM rather than

VRAM. VRAM is dual-ported, which lets two operations occur simultaneously; the screen is updated while new video information is being accessed by the system. VRAM is also more expensive than DRAM, which is not dual-ported.

Designers of DRAM-based boards have to make up for the lack of dual-ported memory, which is critical to the effectiveness of the video boards' WinBench performance. The GD5428-based boards use an asynchronous architecture; buffering writes to memory while the screen and memory refresh are accessing the DRAM. Also, the GD5428 processor (like most of the adapters in this review) handles only two instructions per clock cycle.

This system seems to function well under the less intensive load of Winstone. WinBench, on the other hand, overloads the card with work, showing the limitations in the board's capabilities. Reliance on DRAM is what makes the GD5428-based cards fine performers for general applications but less effective for heavy graphics loads.

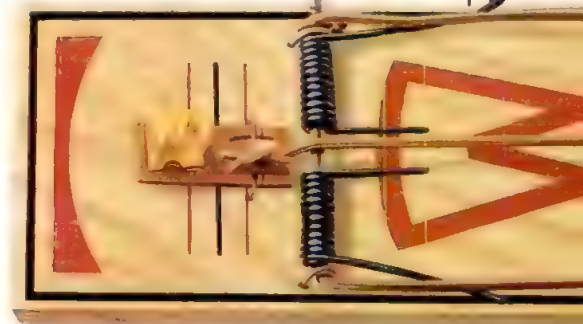
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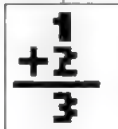
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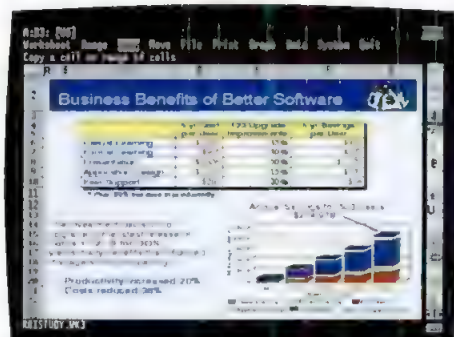
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2MB Video Boards

SUMMARY OF FEATURES

Video Boards

Products listed in alphabetical order

■ = YES □ = NO

VL-Bus ISA

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	Actix GraphicsEngine 32plus/2MB	Actix GraphicsEngine Ultra VL	Actix ProStar VL	Advanced Integration Research Star2000	American Megatrends FastView VLB	Applan Renegade 1280/I	Applan Renegade 1280/V	ATI Graphics Ultra Pro ISA
Company	Actix Systems Inc.	Actix Systems Inc.	Actix Systems Inc.	Advanced Integration Research Inc.	American Megatrends Inc.	Applan Technology Inc.	Applan Technology Inc.	ATI Technologies Inc.
Address	3060 Tasman Dr., Santa Clara, CA 95054	3060 Tasman Dr., Santa Clara, CA 95054	3060 Tasman Dr., Santa Clara, CA 95054	2188 Del Franco St., San Jose, CA 95131	6145-F Northbelt Pkwy., Norcross, GA 30071	477 N. Mathilda Ave., Sunnyvale, CA 94086	477 N. Mathilda Ave., Sunnyvale, CA 94086	33 Commerce Valley Dr. East, Thornhill, Ontario, Canada L3T 7N6
800 number	800-927-5557	800-927-5557	800-927-5557	800-866-1945	800-828-9264	800-727-7426	800-727-7426	None
Toll number	408-986-1625	408-986-1625	408-986-1625	408-428-0800	404-263-8181	408-730-5400	408-730-5400	416-882-2600
Fax number	408-986-1646	408-986-1646	408-986-1646	408-428-0950	404-263-9381	408-730-5473	408-730-5473	416-882-2620
List price	\$249	\$399	\$169	\$475	\$385	\$485	\$425	\$499
Graphics accelerator chip	S3 86C801	S3 86C928	Cirrus GD5428	Weitek P9000	Weitek P9000	AGC 98032	AGC 98032	ATI Mach 32
VGA BIOS manufacturer	Actix	Actix	Cirrus	Phoenix	Phoenix/Weitek	Phoenix	Phoenix	ATI
VGA pass-through connector	Dual-pin	Dual-pin	Dual-pin	Dual-pin	None	Dual-pin	Dual-pin	Dual-pin
Hardware cursor	■	■	■	■	■	■	■	■
Display Characteristics								
Maximum noninterlaced graphics resolution	1,280 x 1,024	1,280 x 1,024	1,024 x 768	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024
Maximum text resolution	132 x 43	132 x 43	132 x 43	132 x 60	132 x 43	132 x 43	132 x 43	132 x 48
Maximum number of colors (noninterlaced)								
1,280 x 1,024	256	256	N/A	256	256	256	256	256
1,024 x 768	256	65,536	256	65,536	65,536	256	256	65,536
800 x 600 (Super VGA)	65,536	16.7 million	65,536	16.7 million	16.7 million	256	256	16.7 million
VESA support	BIOS	BIOS	BIOS	BIOS	BIOS	BIOS	BIOS	BIOS, TSR
Display memory (tested unit)	2MB 45-ns DRAM	2MB 70-ns VRAM	2MB 70-ns DRAM	2MB 70-ns VRAM	2MB 70-ns VRAM	2MB 80-ns VRAM	2MB 80-ns VRAM	2MB 70-ns VRAM
Maximum installable memory	2MB DRAM	2MB VRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM
RAMDAC	Winbond WB2C490P	Brooktree 485	Integrated on accelerator chip	Brooktree 485	Brooktree 485	TI Viewpoint TVP 3010	TI Viewpoint TVP 3010	ATI 68875
Virtual display	■	■	■	□	□	■	■	■
Software Drivers Included								
8514/A	□	□	□	□	□	■	■	■
Lotus 1-2-3	■	■	■	■	□	□	□	■
OS/2 Presentation Manager version	2.1	2.1	2.1	2.1	2.1	None	None	2.1
Ventura Publisher (GEM)	■	■	■	■	□	□	□	■
WordPerfect	■	■	■	■	□	□	□	■
Microsoft Word	■	■	■	■	□	□	□	■
AutoCAD:								
Protected-mode ADI	■	■	■	■	■	■	■	■
Display-list processor	■	■	■	■	■	■	■	■
Other CAD programs	■	■	■	■	■	■	■	■
Customer Support								
Toll-free technical support	■	■	■	□	□	■	■	□
Technical support hours (eastern time)	12:00-9:00 M-F	12:00-9:00 M-F	12:00-9:00 M-F	11:30-8:30 M-F	8:00-8:00 M-F	10:00-7:00 M-F	10:00-7:00 M-F	9:00-5:30 M-F
BBS	■	■	■	■	■	■	■	■
Warranty	2 years	2 years	2 years	1 year	1 year	2 years	2 years	5 years

C&T—Chips & Technologies Inc., IIT—Integrated Information Technology Inc., WD—Western Digital Corp

2MB Video Boards

CONTINUES



ATI Graphics Ultra Pro VLB	Boca Research VL-Bus SuperX VGA	Boca Research Vortek VL-VRAM Accelerator	Boca Research Vortek VRAM Accelerator	Cardinal VideoSpectrum VL	Cardinal WarpSpeed	Diamond Stealth Pro ISA	Diamond Stealth Pro VLB	Diamond Viper VLB	ECS VI-605 VLB
ATI Technologies Inc.	Boca Research Inc.	Boca Research Inc.	Boca Research Inc.	Cardinal Technologies Inc.	Cardinal Technologies Inc.	Diamond Computer Systems Inc.	Diamond Computer Systems Inc.	Diamond Computer Systems Inc.	Elitegroup Computer Systems Inc.
33 Commerce Valley Dr. East, Thornhill, Ontario, Canada L3T 7N6	6413 Congress Ave., Boca Raton, FL 33487	6413 Congress Ave. Boca Raton, FL 33487	6413 Congress Rd., Lancaster, FL 33487	1827 Freedom Rd., Lancaster, PA 17601	1827 Freedom Rd., Lancaster, PA 17601	1130 E. Arques Ave., Sunnyvale, CA 94086	1130 E. Arques Ave., Sunnyvale, CA 94086	1130 E. Arques Ave., Sunnyvale, CA 94086	45225 Northport Ct., Fremont, CA 94538
None	None	None	None	None	None	None	None	None	800-829-8890
416 882-2600	407-997-6227	407-997-6227	407-997-6227	717-293-3049	717-293-3049	408-736-2000	408-736-2000	408-736-2000	510-226-7333
416 882-2620	407-997-0918	407-997-0918	407-997-0918	717-293-3055	717-293-3055	408-730-5750	408-730-5750	408-730-5750	510-226-7350
\$499	\$445	\$595	\$625	\$199	\$599	\$449	\$449	\$499	\$349
ATI Mach 32	Cirrus GD5428	IIT AGX-014	IIT AGX-015	Cirrus 5428	Weitek P9000	S3 86C928	S3 86C928	Weitek P9000	ATI Mach 32
ATI	Boca	Boca	Boca	Cirrus	Weitek	Diamond	Diamond	Diamond	ATI
Dual-pin	Dual-pin	Dual-pin	Dual-pin	Dual-pin	None	Dual-pin	Dual-pin	None	Dual-pin
■	■	■	■	■	■	■	■	■	■
1,280 x 1,024	1,024 x 768	1,280 x 1,024	1,280 x 1,024	1,024 x 768	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024
132 x 48	132 x 43	80 x 60	80 x 60	132 x 43	132 x 60	132 x 43	132 x 43	132 x 43	132 x 60
256	N/A	16	256	256	256	256	256	256	256
65,536	65,536	65,536	65,536	256	65,536	65,536	65,536	65,536	65,536
16.7 million	65,536	16.7 million	16.7 million	65,536	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million
BIOS, TSR	BIOS	In driver	In driver	BIOS	BIOS	BIOS	BIOS	In driver	BIOS
2MB 70-ns VRAM	2MB 60-ns DRAM	2MB 70-ns VRAM	2MB 60-ns VRAM	2MB 60-ns DRAM	2MB 70-ns VRAM	2MB 60-ns VRAM	2MB 60-ns VRAM	2MB 60-ns VRAM	2MB 80-ns VRAM
2MB VRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM
ATI 68875	Integrated on accelerator chip	Sierra 15025	Sierra 15025	Integrated on accelerator chip	Brooktree 485	Diamond SS2410	Diamond SS2410	Brooktree 485	ATI 68875
■	□	□	□	□	□	■	■	□	□
■	□	□	□	□	□	□	□	□	■
■	■	□	□	□	■	■	■	□	■
2.1	2.0	2.1	2.1	2.0	2.0	2.1	2.1	2.1	2.0
■	■	□	□	■	■	□	□	□	■
■	■	■	■	■	■	■	■	□	■
■	■	□	□	■	■	■	■	□	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	□	■	■	□	■
□	□	□	□	□	□	□	□	□	■
9:00-5:30 M-F	8:00-7:00 M-F	8:00-7:00 M-F	8:00-7:00 M-F	8:00-6:00 M-F	8:00-6:00 M-F	9:00-10:00 M-F 11:00-7:00 Sat	9:00-10:00 M-F 11:00-7:00 Sat	9:00-10:00 M-F 11:00-7:00 Sat	12:00-8:00 M-F
■	■	■	■	■	■	■	■	■	■
5 years	5 years	5 years	5 years	1 year	1 year	5 years	5 years	5 years	1 year



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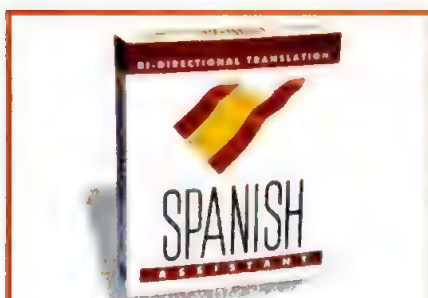
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 8535 pcANYWHERE DOS 119.95 11303 Windows 129.95
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10702	Tape250 Parallel Port Tape Backup			429.95
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Kao	
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11869 (30)	35.95
11867 3.5" HD Disks (50)	50.95
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GRAPHICS HARDWARE

2MB Video Boards

S U M M A R Y O F F E A T U R E S

Products listed in alphabetical order

■ = YES □ = NO



	VL-Bus	ISA	ISA/EISA					
	ELSA Winner 1000	ELSA Winner 1000VL	Focus 2 the Max TrueSpeed W32i	Genoa WindowsVGA 24 Turbo	Hercules Graphite Pro	Hercules Graphite VL Pro	Matrox MGA Ultima, ISA Version	Matrox MGA Ultima, VLB Version
Company	ELSA America Inc.	ELSA America Inc.	Focus Information Systems Inc.	Genoa Systems Corp.	Hercules Computer Technology Inc.	Hercules Computer Technology Inc.	Matrox Electronic Technology Inc.	Matrox Electronic Systems Ltd.
Address	400 Oyster Point Blvd., #109, S. San Francisco, CA 94080	400 Oyster Point Blvd., #109, S. San Francisco, CA 94080	4046 Clipper Ct., Fremont, CA 94538	75 E. Trimble Rd., San Jose, CA 95131	3839 Spinnaker Ct., Fremont, CA 94538	3839 Spinnaker Ct., Fremont, CA 94538	1055 St-Regis Blvd., Dorval, Quebec, Canada H9P 2T4	1055 St-Regis Blvd., Dorval, Quebec, Canada H9P 2T4
800 number	800-272-3572	800-272-3572	800-925-2378	800-934-3662	800-532-0600	800-532-0600	800-361-1408	800-361-1408
Toll number	415-615-7799	415-615-7799	510-657-2845	408-432-9090	510-623-6030	510-623-6030	514-685-2630	514-685-2630
Fax number	415-588-0113	415-588-0113	510-657-4158	408-434-0997	510-623-1112	510-623-1112	514-685-2853	514-685-2853
List price	\$599	\$599	\$279	\$289	\$549	\$549	\$849	\$899
Graphics accelerator chip	S3 86C928	S3 86C928	Tseng ET4000/W32i	Cirrus 5428	IIT AGX015	IIT AGX015	Matrox MGA 64-BLT	Matrox MGA 64-BLT
VGA BIOS manufacturer	ELSA	ELSA	Focus	Genoa	Hercules	Hercules	LSI Logic	LSI Logic
VGA pass-through connector	Dual-pin	Dual-pin	Dual-pin	None	Dual-pin	Dual-pin	None	None
Hardware cursor	■	■	■	■	■	■	■	■
Display Characteristics								
Maximum noninterlaced graphics resolution	1,280 x 1,024	1,280 x 1,024	1,024 x 768	1,024 x 768	1,280 x 1,024	1,280 x 1,024	1,600 x 1,200	1,600 x 1,200
Maximum text resolution	132 x 43	132 x 43	164 x 64	132 x 43	80 x 50	80 x 50	132 x 25	132 x 25
Maximum number of colors								
1,280 x 1,024 (noninterlaced):	256	256	256	N/A	256	256	256	256
1,024 x 768	65,536	65,536	65,536	65,536	65,536	65,536	32,768	32,768
800 x 600 (Super VGA)	65,536	65,536	65,536	65,536	16.7 million	16.7 million	16.7 million	16.7 million
VESA support	BIOS	BIOS	In driver	In driver	TSR	TSR	In driver	In driver
Display memory (tested unit)	2MB 80-ns VRAM	2MB 80-ns VRAM	2MB 45-ns DRAM	2MB 70-ns DRAM	2MB 70-ns VRAM	2MB 70-ns VRAM	2MB 80-ns VRAM	2MB 80-ns VRAM
Maximum installable memory	2MB VRAM	2MB VRAM	2MB DRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB VRAM
RAMDAC	Sierra 15025CV	Sierra 15025CV	AT&T 20G490	Integrated on accelerator chip	Brooktree 481, Brooktree 485	Brooktree 481, Brooktree 485	Brooktree 485	Brooktree 485
Virtual display	■	■	■	□	■	■	■	■
Software Drivers Included								
8514/A	□	□	■	□	□	□	□	□
5Lotus 1-2-3	■	■	■	■	□	□	□	□
OS/2 Presentation Manager version	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Ventura Publisher (GEM)	■	■	■	■	□	□	□	□
WordPerfect	□	□	■	■	□	□	□	□
Microsoft Word	□	□	■	■	□	□	□	□
AutoCAD:								
Protected-mode ADI	■	■	■	■	■	■	■	■
Display-list processor	■	■	■	■	■	■	■	■
Other CAD programs	■	■	■	■	■	■	■	■
Customer Support								
Toll-free technical support	■	■	□	■	□	□	■	■
Technical support hours (eastern time)	11:00-8:00 M-F	11:00-8:00 M-F	11:00-8:00 M-F	11:00-8:00 M-F	10:00-8:00 M-F	10:00-8:00 M-F	8:00-6:00 M-F	8:00-6:00 M-F
BBS	■	■	■	■	■	■	■	■
Warranty	3 years	3 years	2 years	2 years	2 years	2 years	2 years	2 years

C&T—Chips & Technologies Inc., IIT—Integrated Information Technology Inc., WD—Western Digital Corp

2MB Video Boards

CONTINUES

Metheus Premier 928-2M	Metheus Premier 928-VL2	Micro-Labs Ultimate True Color/VL/XL2	Nth Edge 1280	Nth S3 Advantage VL	Number Nine #9GXE	Number Nine #9GXE VLB	Orchid Celsius/VLB	Orchid Fahrenheit VA/VLB	Sigma Designs Concorde VLB
Metheus Corp.	Metheus Corp	Micro-Labs Inc.	Nth Graphics Ltd.	Nth Graphics Ltd.	Number Nine Computer Corp	Number Nine Computer Corp.	Orchid Technology Inc.	Orchid Technology Inc.	Sigma Designs Inc
1600 N W Compton Dr., Beaverton, OR 97006	1600 N W Compton Dr., Beaverton, OR 97006	204 Lost Canyon Ct., Richardson, TX 75080	11500Metric Blvd. #210, Austin, TX 78758	11500Metric Blvd #210, Austin, TX 78758	18 Hartwell Ave Lexington, MA 2173	18 Hartwell Ave Lexington, MA 2173	45365 Northport Loop West, Fremont, CA	45365 Northport Loop West, Fremont, CA	47900 Bayside Pkwy., Fremont, CA 94538
800-638-4387	800-638-4387	None	800-624-7552	800-624-7552	800-438-6463	800-438-6463	800-767-2443	800-767-2443	800-845-8086
503-690-1550	503-690-1550	214-234-5842	512-832-1944	512-832-1944	617-674-0009	617-674-0009	510-683-0300	510-683-0300	510-770-0100
503-690-1525	503-690-1525	214-234-5896	512-832-5954	512-832-5954	617-674-2919	617-674-2919	510-490-9312	510-490-9312	510-770-2640
\$549	\$578	\$258	\$995	\$595	\$495	\$495	\$399	\$349	\$249
S3 86C928	S3 86C928	Tseng ET4000/W32i Tseng	C&T 481	S3 86C805	S3 86C928	S3 86C928	11T AGX015	S3 86C805	Tseng ET4000/W32i Sigma
AMI	AMI		N/A	Quadtel	Number Nine/Quadtel	Number Nine/Quadtel	Orchid	Orchid	
Dual-pin	Dual-pin	None	Dual-pin	Dual-pin	None	Dual-pin	Dual-pin	Dual-pin	Dual-pin
■	■	■	■	□	■	■	■	■	■
1,280 x 1,024	1,280 x 1,024	1,024 x 768	1,280 x 1,024	1,024 x 768	1,280 x 1,024	1,280 x 1,024	1,600 x 1,200	1,024 x 768	1,024 x 768
132 x 48	132 x 48	132 x 60	N/A	132 x 43	132 x 48	132 x 48	132 x 60	132 x 44	132 x 44
256	256	N/A	256	N/A	256	256	256	N/A	N/A
65,536	65,536	256	65,536	256	65,536	65,536	65,536	65,536	256
65,536	65,536	65,536	65,536	65,536	65,536	65,536	16.7 million	65,536	65,536
BIOS	BIOS	In driver	None	BIOS	BIOS	BIOS	BIOS, TSR	BIOS	TSR
2MB 70-ns VRAM	2MB 70-ns VRAM	2MB 45-ns DRAM	2MB 80-ns VRAM	2MB 60-ns DRAM	2MB 60-ns VRAM	2MB 60-ns VRAM	2MB 80-ns VRAM	2MB 60-ns DRAM	2MB 45-ns DRAM
2MB VRAM	2MB VRAM	2MB DRAM	2MB VRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB VRAM	2MB DRAM	2MB DRAM
AT&T 20C491	AT&T 20C491	AT&T 20C491	Brooktree 485	AT&T 20C491	Brooktree 485	Brooktree 485	Sierra 15025CV	AT&T 20C491	AT&T 20C490
■	■	□	□	□	■	■	■	■	□
□	□	■	■	□	□	□	□	□	□
■	■	■	□	□	■	■	□	■	■
2.1	2.1	2.1	None	2.1	2.1	2.1	2.1	2.1	None
■	■	■	□	□	□	□	□	□	□
■	■	■	□	□	■	■	■	■	■
■	■	■	□	□	■	■	□	■	□
■	■	■	■	■	■	■	■	■	□
■	■	■	■	■	■	■	■	■	■
■	■	□	□	□	■	■	■	■	□
■	■	□	■	■	■	■	□	□	□
11:00-8:00 M-F	11:00-8:00 M-F	9:30-4:30 M-F	9:00-7:00 M-F	9:00-7:00 M-F	8:00-8:00 M-F	8:00-8:00 M-F	10:00-8:00 M-F	10:00-8:00 M-F	N/A
■	■	■	■	■	■	■	■	■	■
2 years	2 years	3 years	5 years return and repair, 1 year over-night hardware	5 years return and repair, 1 year over-night hardware	5 years	5 years	4 years	4 years	5 years

► SUMMARY OF FEATURES

ENDS

Products listed in alphabetical order

■ = YES □ = NO

■ VL-Bus ■ ISA

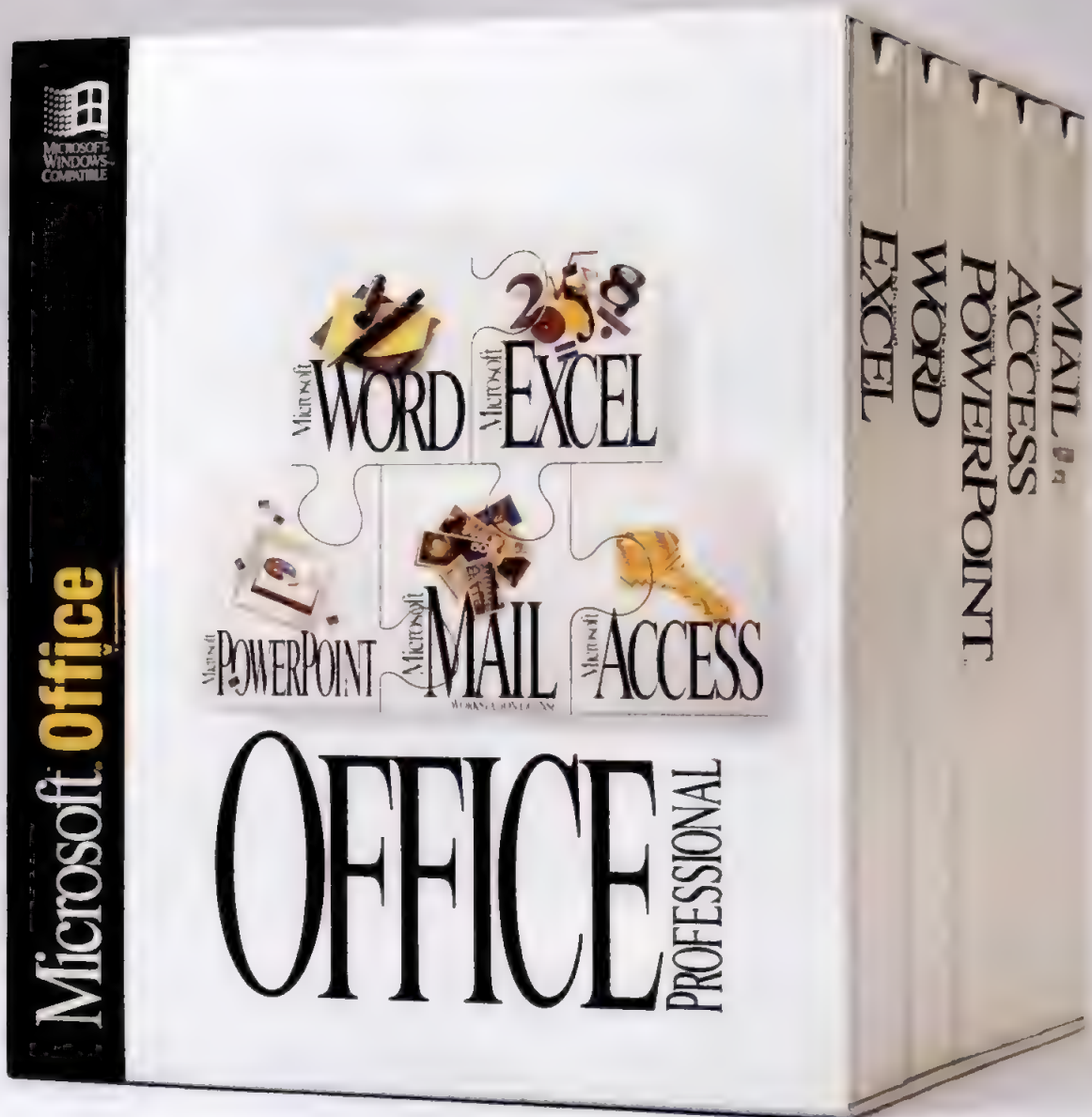
	SPiDER Black Widow VLE	VidTech GraphMax	VidTech GraphMax LB	Volante Warp10LB-2	Volante Warp20-2	Western Digital Paradise Accelerator Pro	Western Digital Paradise Accelerator VL Plus
Company	SPiDER Graphics Inc.	VidTech Microsystems Inc.	VidTech Microsystems Inc.	Volante Inc.,	Volante Inc.,	Western Digital Corp.	Western Digital Corp.
Address	801 Ames Ave., Milpitas, CA 95035	1700 93rd Ln. N.E., Minneapolis, MN 55449	1700 93rd Ln. N.E., Minneapolis, MN 55449	1515 Capital of Texas Hwy.South, 5th Floor, Austin, Texas 78746	1515 Capital of Texas Hwy.South, 5th Floor, Austin, Texas 78746	8105 Irvine Center Dr., Irvine, CA 92718	8105 Irvine Center Dr., Irvine, CA 92718
800 number	None	800-752-8033	800-752-8033	800-253-8831	800-253-8831	800-832-4778	800-832-4778
Toll number	408-956-1231	612-780-8033	612-780-8033	512-329-5055	512-329-5055	714-932-4900	714-932-4900
Fax number	408-956-1342	612-780-2040	612-780-2040	512-329-6326	512-329-6326	714-932-6498	714-932-6498
List price	\$299	\$349	\$399	\$399	\$499	\$349	\$299
Graphics accelerator chip	IIT AGX015	IIT AGX-014	IIT AGX-015	S3 86C805	IIT AGX-014	IIT AGX-014	WD 90C33
VGA BIOS manufacturer	SPiDER	VidTech	VidTech	Quadtel	IIT	XTechnology	WD
VGA pass-through connector	Dual-pin	Dual-pin	Dual-pin	Dual-pin	Edge	Dual-pin	Dual-pin
Hardware cursor	■	■	■	■	■	■	■
Display Characteristics							
Maximum noninterlaced graphics resolution	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,280 x 960	1,280 x 1,024	1,024 x 768
Maximum text resolution	132 x 50	160 x 64	160 x 64	132 x 43	132 x 60	132 x 50	132 x 50
Maximum number of colors (noninterlaced)							
1,280 x 1,024	16	16	256	16	256	16	N/A
1,024 x 768	65,536	65,536	65,536	65,536	65,536	256	256
800 x 600 (Super VGA)	16.7 million	16.7 million	16.7 million	65,536	16.7 million	16.7 million	65,536
VESA support	BIOS	In driver	In driver	BIOS	TSR	TSR	TSR
Display memory (tested unit)	2MB 70-ns VRAM	2MB 60-ns VRAM	2MB 60-ns VRAM	2MB 60-ns DRAM	2MB 80-ns VRAM	2MB 70-ns VRAM	2MB 45-ns DRAM
Maximum installable memory	2MB VRAM	2MB VRAM	2MB VRAM	2MB DRAM	2MB VRAM	2MB VRAM	2MB DRAM
RAMDAC	Sierra 15025CV	Sierra 15025	Sierra 15025	AT&T 20C490	AT&T 20C490	Sierra 15025	Sierra 15025
Virtual display	□	■	■	■	■	□	□
Software Drivers Included							
8514/A	□	□	□	■	■	□	□
Lotus 1-2-3	■	■	■	■	□	□	■
OS/2 Presentation Manager version	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Ventura Publisher (GEM)	□	□	□	□	□	□	□
WordPerfect	■	■	■	■	■	■	■
Microsoft Word	□	□	□	■	■	□	■
AutoCAD:							
Protected-mode ADI	■	■	■	■	■	■	■
Display-list processor	■	■	■	■	■	■	■
Other CAD programs	■	■	■	■	■	■	■
Customer Support							
Toll-free technical support	□	■	■	■	■	■	■
Technical support hours (eastern time)	12:30-9:00 M-F	8:00-7:00 M-F	8:00-7:00 M-F	8:00-8:00 M-F	8:00-8:00 M-F	11:00-8:00 M-F	11:00-8:00 M-F
BBS	■	■	■	■	■	■	■
Warranty	2 years	5 years	5 years	Limited lifetime	Limited lifetime	3 years	3 years

C&T—Chips & Technologies Inc., IIT—Integrated Information Technology Inc., WD—Western Digital Corp.

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BEEN THE SAME.**

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REPEATS ITSELF.**

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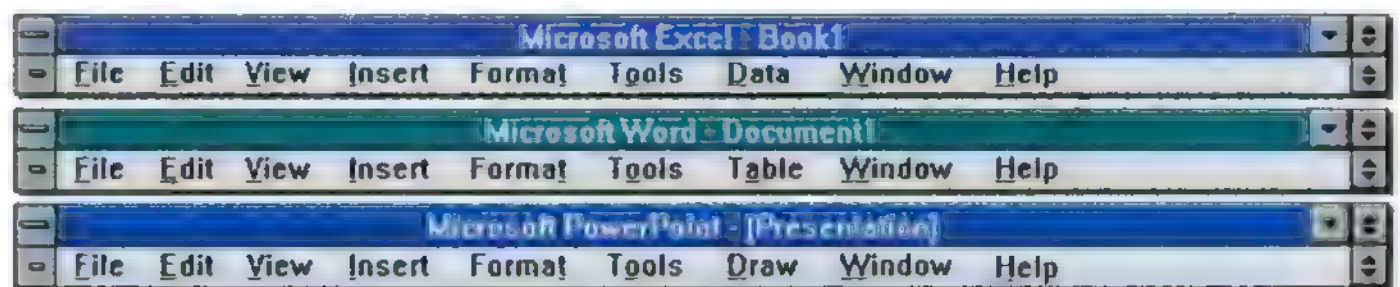
We've gone right to the core of all our renowned programs for Windows™ and evolved them into a single, intelligent, effortless working

functions, and a lot more. Now your 100 most common tasks can be done in one step.

Working as one.

One of the main things you told us was that you want programs which look and work alike. So we made it happen.

These menus from Microsoft Excel, Word and PowerPoint demonstrate a design consistency you'll also find in our toolbars, dialog boxes, and buttons.



environment. Now you can focus on your work, not your computer.

You've helped us create all the best innovations.

The Microsoft Office couldn't have happened without a lot of concrete feedback from you. We've studied how you work and used your suggestions to develop great computing solutions. In our usability lab, 15 full-time scientists constantly watch how people use our products. In fact, we've tracked over 1.5 million user actions to understand just how you work with your computer.

Click on any icon in the Microsoft Office Manager and it instantly moves you from one program to another.



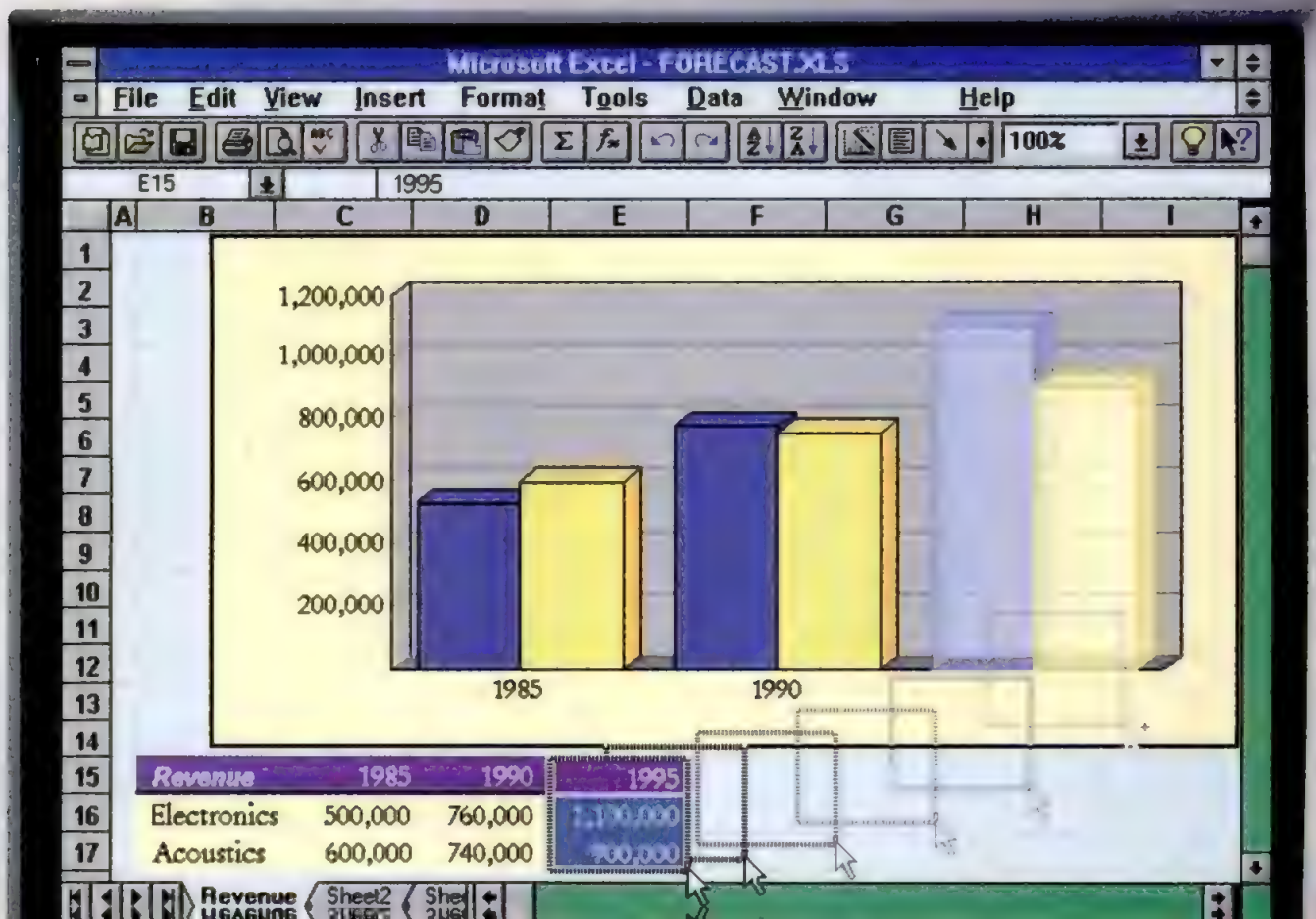
That's why Microsoft consistently pioneers better ways to work. And the new Microsoft Office continues in the tradition that brought you toolbars, wizards, automatic

For example, in the new versions of Microsoft Excel, Word and PowerPoint, eight of the nine top level menu commands are the same.

And that's only the beginning. You can install the Microsoft Office in one integrated step and use the same shared tools like Microsoft Graph, WordArt and Spelling checker across all the programs. And the intuitive Microsoft Office Manager (MOM) makes it easy to use all these innovations together.

The Microsoft Office family of programs is the most popular office suite for the Windows and the Macintosh® operating systems because it's built from the ground up by one company with one cohesive design philosophy. It all adds up to a whole new way to work.

**ONLY THE MICROSOFT
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BUILT-IN INTELLIGENCE
THAT UNDERSTANDS WHAT
YOU NEED AND HOW TO
DO IT BEST.**



With the Microsoft Office, IntelliSense™ technology has arrived. IntelliSense recognizes what you want to accomplish, adapts to the personal way you work, and delivers intelligent results. Now repeti-

simply dragging the information there. What used to take a number of steps now happens in one.

Guiding. Informing. Thinking ahead.

IntelliSense technology also means you have wizards and Cue Cards that inform you and guide you easily through more complex jobs like charting, designing presentations, customizing form letters, and creating data entry forms.

For instance, the TipWizard in Microsoft Excel observes how you work. Based on your individual patterns, it gives you tips on new ways to finish tasks with less effort. There's no easier way for you to discover how to reduce steps and save time. And avoid a trip to the manual.

The PivotTable Wizard guides you through building summary tables of your data. Now you can drag and drop your headings, then view and analyze your work from every angle.

The powerful engineering in IntelliSense could only happen through our commitment to your ideas and to turning them into solutions you need. And only Microsoft can bring this much great thinking together all in one place.

The AutoCorrect feature in Word fixes typos as you make them. Automatically.

SHip teh cartons
friday.

Ship the cartons
Friday.

tive jobs are automatic, complex jobs are easier, and your computer is working much smarter.

The basics are automatic.

Most everyday routines that you have to do, just to get to the real work, now happen automatically.

The exclusive AutoCorrect feature in new Word 6.0 instantly fixes typos as fast as you make them. That's one less thing to think about.

AutoFormat analyzes your document, instantly picks a format (or allows you to customize one) and makes your work look great.

In new Microsoft Excel 5.0, you can use the innovative AutoFilter to look quickly at different parts of your data, with the click of your mouse.

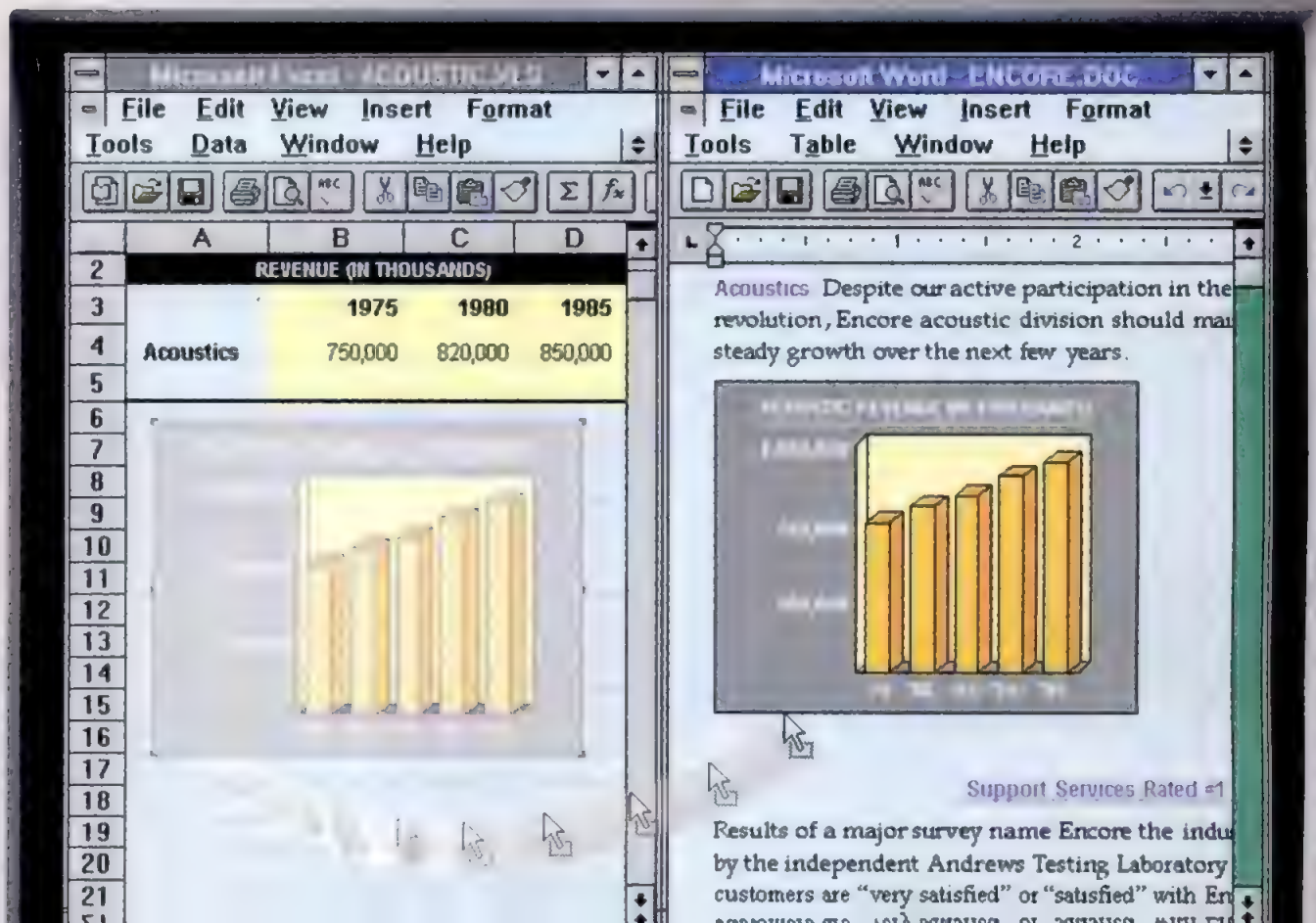
And the Drag and Plot feature lets you add a new row or column of data to your charts by



The TipWizard in Microsoft Excel tracks the way you work and offers bright ideas on how to save time.

Pictured at left, the Drag and Plot feature in Microsoft Excel enables you to update your chart instantly with new data. Just drag the new data and drop it into your chart.

ONLY MICROSOFT HAS OFFICELINKS. NOW IT'S SIMPLE TO SHARE DATA BETWEEN PROGRAMS WITHOUT LEAVING YOUR DOCUMENT.



New OfficeLinks makes it simple to share text, data, and graphics between programs, and lets you put them all together in the same document. You asked for innovation, and this delivers in a big way.

At the heart of OfficeLinks is

With OfficeLinks, it's effortless to mail merge your Microsoft Access data into a Word document. Lower right: Routing lets everyone in your workgroup share comments and information.



the latest Object Linking and Embedding technology (OLE 2.0). It's an open industry standard that helps everything in the Microsoft Office work together, even with software from other companies.

Drag and Drop between programs. Instantly.

Here's what moving information between documents is like: Drag a chart from Microsoft Excel and drop it into Word. Job done.

Hit the "Present It" toolbar button in Word, it'll automatically transfer your work to new PowerPoint 4.0 for an instant presentation.

Link data from Microsoft Access® with your Word document and you've got personalized letters for your entire customer base. Fast.

The end of jumping between applications.

OfficeLinks lets you edit in

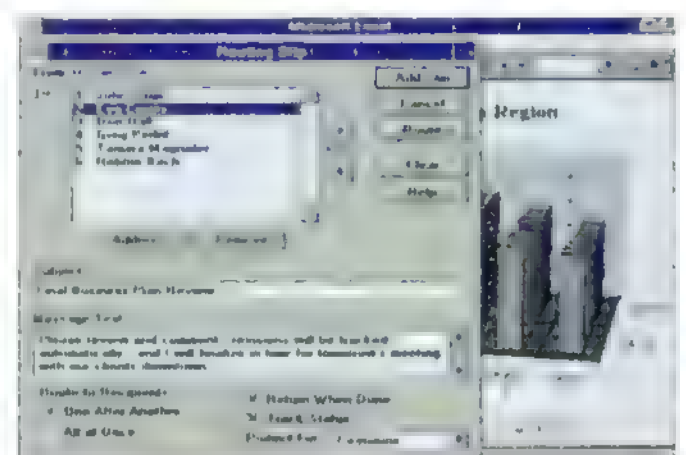
place. In one place. Maybe you have a Microsoft Excel chart in the Word memo you're writing. And you need to change some figures. Click on the chart and instantly have all your spreadsheet tools to make the changes. Without ever leaving your Word document.

We call it Visual Editing. And once you've seen it in action, you'll understand just how integrated the Microsoft Office is. Moving, sharing and editing data between applications has changed forever.

Together in every way.

The Microsoft Office is bringing workgroups together, too. Your whole group can manage and edit documents as a team. Use the Routing feature to forward your draft, collect comments and merge the results.

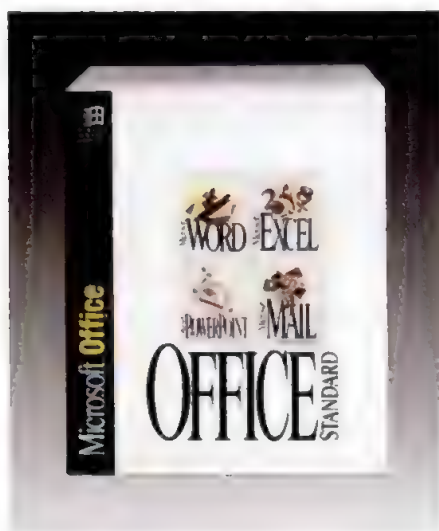
Only the Microsoft Office lets you share files and macros between the PC and Macintosh. And through Visual Basic™ for Applica-



tions, the new Microsoft Office provides a powerful development platform for custom solutions.

Pictured at left, sharing data between programs is as easy as dragging it from one and dropping it into the other.

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Until December 31, through a special offer for Microsoft customers, you can upgrade to Microsoft Office Standard edition, featuring Word 6.0, for \$259. That's more than 30% off what you'd pay for these

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Microsoft Office



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These all turned in extremely high DOS video scores. The company's frame-buffer past is reflected in scores that are well above average. These cards will do well in the DOS-based application world.

AutoCAD test scores fell into a fairly broad range. The VL-Bus SuperX VGA and the ProStar had above-average scores of 12.7 and 12.4, respectively. The VideoSpectrum VL performed slightly below average, with a score of 11.4. The WindowsVGA 24 Turbo tied for last, with a score of 10 seconds. The difference in the AutoCAD scores reflect the effectiveness of each software driver.

FEATURES

While all these boards offer at least a 72-Hz refresh rate in 800-by-600 and 1,024-by-768 with 256 colors, the WindowsVGA 24 Turbo's refresh rates were exceptional: 90 Hz in 800-by-600 with 256 colors and 75 Hz in 1,024-by-768 with 256 colors. Also exceptional was the 87-Hz refresh rates posted by all the GD5428-based boards in 1,280-by-1,024 with 256 colors.

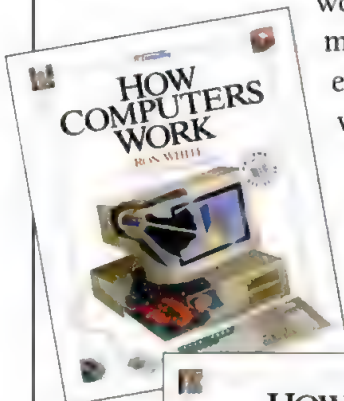
The Genoa Windows VGA24 VL Turbo has a particularly easy install utility that allows you to switch resolutions without entering the windows Setup program. A Safe Scan utility allows you to control screen scan areas. The Actix ProStar VL and the Cardinal VGA800VL also had easy, no-frills installation. The Boca Super XVGA VLB, which was the most expensive board, was the most difficult to install and was far less automated than the other boards.

All the cards based on the GD5428 ship with resolution- and color-depth-mode switching utilities that run under Windows as icons. These utilities let the user switch modes without having to enter the Windows Setup program, and restart Windows with a mouse click. In all resolutions, Windows ran with no screen flicker or distortions.

The four video cards we looked at in this review initially had similar problems with the Windows device drivers. The new Windows benchmarks' robust use of the Windows API revealed the existing drivers' compatibility problems. Cirrus Logic corrected the problems by providing updated device drivers.

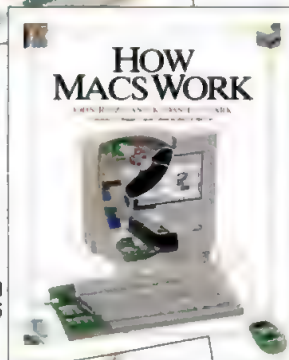
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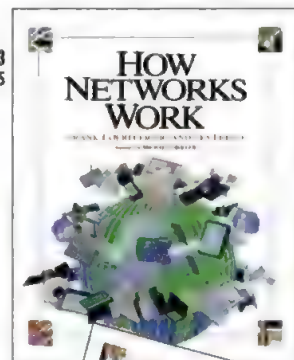


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Price: \$24.95

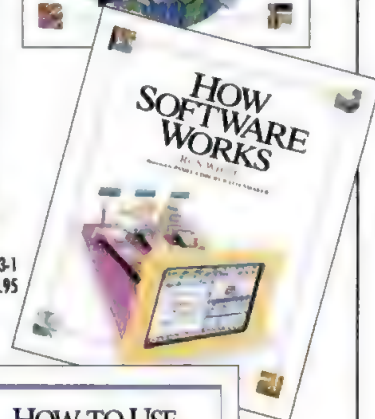
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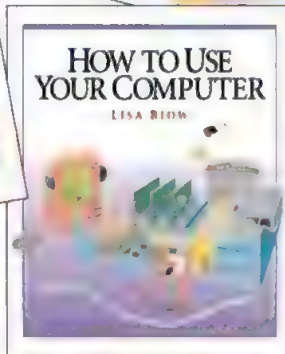
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VidTech GraphMax

Volante Warp20-2

**Western Digital Paradise
Accelerator Pro**

► IIT AGX-015-BASED CARDS

**Boca Research Vortek
VL-VRAM Accelerator**

Hercules Graphite Pro

Hercules Graphite VL Pro

Orchid Celsius/VLB

SPiDER Black Widow VLB

VidTech GraphMax LB

BY BRADLEY EPRANIAN

We reviewed ten video boards based on the IIT family of chips: The four ISA cards use the IIT AGX-014 chip, and the five VL-Bus cards and one ISA card use the more advanced, IIT AGX-015 chip. Compared with most boards in this review, those based on the AGX-014 were slower performers. The boards based on the AGX-015 delivered good results during normal application use and above-average performance on graphics-intensive applications. The AGX-based boards' advantage is that both ISA and VL-Bus versions support 24-bit color in 800-by-600 resolution. However, their relative performance in that mode was not sterling.

The prices of these ten boards varied widely. The cards based on the AGX-014 were the \$349 VidTech GraphMax, \$349 Western Digital Paradise Accelerator Pro, \$499 Volante Warp20-2, and \$595 Boca Research Vortek VRAM Accelerator. Those based on the AGX-015 included the \$299 Black Widow VLB

(from SPiDER Graphics), \$399 VidTech GraphMax VL, \$429 Orchid Celsius/VLB, \$549 Hercules Graphite Pro and Hercules Graphics VL Pro, and \$625 Boca Research Vortek VL-VRAM Accelerator.

In general, the cards based on the AGX-015 were faster than those based on the AGX-014. They are all VL-Bus cards, except for the ISA-based, Hercules Graphite Pro.

Both versions of the Hercules card were the standouts among the adapters based on the IIT chip. Both had good WinBench and Winstone results, decent AutoCAD scores, and excellent software. The ISA version's performance was almost on a par with its VL-Bus counterpart. At \$549 it is not cheap, but if you have an ISA-bus machine and want 24-bit capabilities, the Graphite Pro is a good buy.

AGX-014-BASED BOARDS

On our WinBench tests, the cards using the AGX-014 chip generally were near the bottom of the pack in terms of performance and had mediocre video scores. Most of their Winstone results were below average as well. Among the ISA-only cards in our review, the ISA-bus cards using the AGX-014 produced average results.

An advantage of the AGX-014 ISA cards was their support for 24-bit color in 800-by-600 resolution, which most other ISA cards and many VL-Bus cards in this roundup did not support.

On our AutoCAD test, the Boca Research and Western Digital boards were average, (twenty-first and eighteenth, respectively) among all boards tested. But the Paradise Accelerator Pro ranked third and the Vortek VRAM Accelerator fifth among the 13 ISA cards we reviewed, with well above average scores. This was the only bright spot in the AGX-014 group's AutoCAD performance. The VidTech GraphMax LB's results were below average, and the Warp20-2 could not run the test. AutoCAD performance is an indication of how well the cards and software run a protected-mode intense graphical load. It also provides insight into how well a vendor has implemented application-specific device drivers.

AGX-015-BASED BOARDS

The VL-Bus cards with AGX-015 chips generally earned above-average Graphics WinMark scores in 800-by-600 mode with 256 colors. The Graphite VL Pro was the top performer, garnering a score of 11 million pixels per second using 8MB of RAM and 10.9 million pixels per second using 16MB of RAM—thirteenth-place rankings. The AGX-015 boards also posted good Graphics WinMark results in 1,024-by-768 mode with 256 colors. And on these tests, the Black Widow was the second-fastest card that uses an AGX-015. The Graphite Pro turned in average scores, compared with those of the entire

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43-adapter test group, but its performance was above average among the ISA-only cards. The Winstone results for the VL-Bus group based on the AGX-015 were all slightly above average.

For PC Bench 8.0, all the cards based on the AGX-015 scored below average. The Graphite Pro scored below the ISA-card average as well. Based on these results, these cards are not the strongest performers for DOS-based applications.

In 800-by-600 mode with 16.7 million colors, the Graphite VL Pro's Graphics WinMark score of 2.3 million was the best of the IIT AGX-015 group, and was average for the overall test group's 24-bit average. The Graphite Pro scored 1.8 million, which was just above the 1.6-million average for ISA cards and second only to the ISA-version Matrox MGA Ultima, which scored 5.9 million.

On the AutoCAD test, the Vortek VL-VRAM Accelerator and the Orchid Celsius/VLB were the only cards using the AGX-015 to score above the average for the 43 cards. The Vortek VL-VRAM Accelerator ranked sixth, followed by the twelfth-place Celsius/VLB. The rest of the cards based on the AGX-015 scored below



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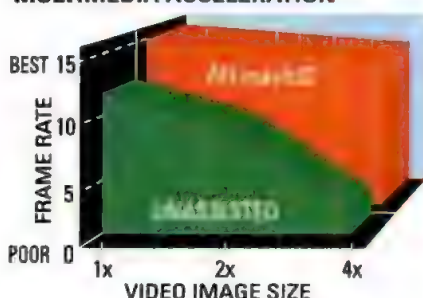
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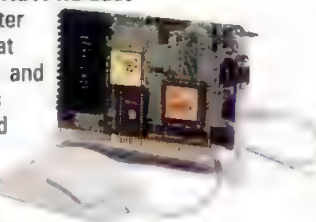
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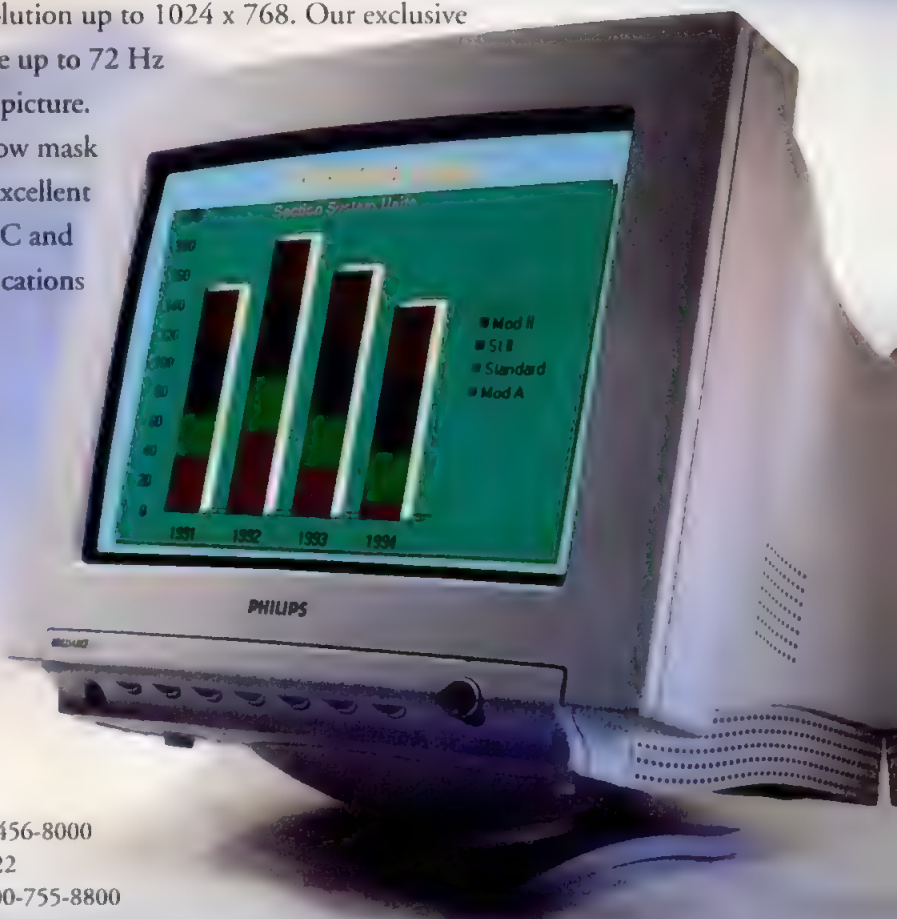
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average. The Graphite Pro placed below the average among the other ISA cards.

FEATURES

Both the ISA and VL-Bus versions of the Hercules card ship with excellent software and utilities. Their install programs were smooth and easy. The resolution-switching utility installed as a Microsoft Windows icon, and a mouse click enabled "on-the-fly" screen resolution changes and Windows 3.1 to be restarted. The utility supported a virtual screen size of 2,048-by-768 at a 1,024-by-768 resolution in the same easy manner. The virtual screen had no flicker and scrolled well on the VL-Bus and ISA platforms. The Hercules cards also

Both the ISA and VL-Bus versions of the Hercules card ship with excellent software and utilities. Their install programs were smooth and easy.

shipped with a demonstration utility that showed their performance and capabilities. However, the hardware zoom utility was not intuitive, and it was difficult for us to get it to work.

The Warp20-2 had a quick install program that lets the user enter Windows without running the Window Setup program. A pan utility is included, as well as an icon-based resolution-switching utility.

The Black Widow had a pleasing install utility, but the utility for resolution switching produced flashing and spotting. The Celsius/VLB has a good resolution-switching utility, but it suffered from a noticeable scroll-bar flicker at higher resolutions. Also, the graphics screen started to flash when running DOS in a window.

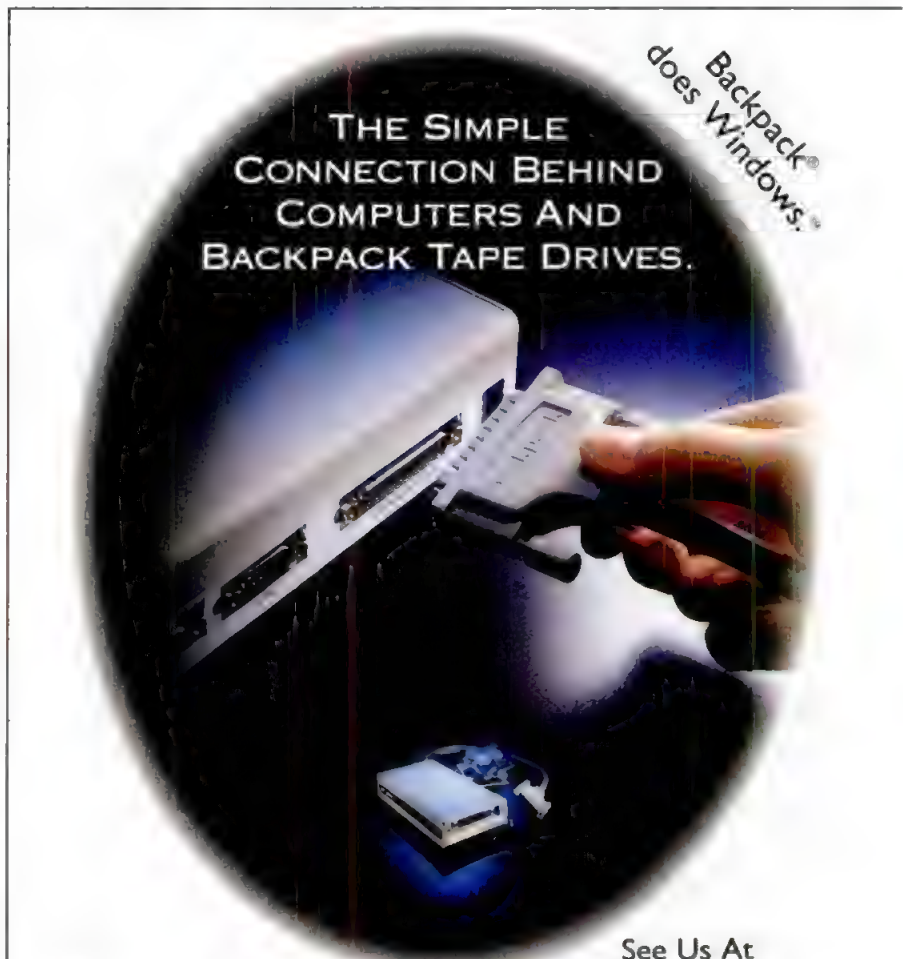
The Paradise Accelerator Pro's install ran from Windows, was easy to install, and has an icon-based on-the-fly resolution-switching utility. Unfortunately, a Windows system-error box kept appearing when we tried to run DOS in a window.

The Vortex VL-VRAM Accelerator and Vortex VRAM Accelerator install and

mode-switching utilities were not automated; the user has to enter the Windows Setup program and manually switch the drivers. The GraphMax and GraphMax LB also lacked automated setup and mode-switching utilities. Its install program had bugs and text-mode problems.

The Graphite Pro and Graphite VL Pro had high refresh rates—supporting 800-by-600 at 72 Hz with 16.7 million colors, 800-

by-600 with 256 colors and 1,024-by-768 with 256 colors (both at 90 Hz), and 1,280-by-1,024 with 256 colors at 75 Hz. The other boards based on the AGX-014 and AGX-015 had satisfactory refresh rates in all tested modes except 800-by-600 with 16.7 million colors, where their refresh rates were in the 50- to 60-Hz range. This makes them poor choices for driving large monitors in 800-by-600 mode with 16.7 million colors.



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AGX-014 VS. AGX-015

Based on a RISC engine, the IIT chips support the IBM XGA standard (running four operations per instruction) and are backward-compatible with VGA, EGA, CGA, and Hercules standards. IIT claims that each chip can accommodate up to 6MB of VRAM. However, the AGX-014 is not readily upgradable (it requires glue logic). The AGX-014 supports only the ISA bus and a maximum resolution of 1,280-by-1,024 with 16.7 million colors. The AGX-015 supports both ISA and the VL-Bus. It is also capable of 1,600-by-1,200 with 16.7 million colors. The AGX-014's memory clock can run at 55 MHz, while the AGX-015's runs at 65 MHz. The AGX-015 also has accelerated graphical user interface (GUI) functions optimized to run faster (such as BitBlts, line draws, complex polygon fills, circles, ellipses, and surface mapping and shading). IIT is developing an AGX-016 chip, which will support the PCI-bus interface.

► MATROX MGA-BASED CARDS



**Matrox MGA Ultima,
ISA Version**



**Matrox MGA Ultima,
VLB Version**

BY JAMES KARNEY

The two Matrox Ultima MGA boards are a good choice for Microsoft Windows power users and people who require high-end graphics capabilities. While some other cards we tested scored higher on our benchmark tests in several categories, these two boards were the top performers in 800-by-600 mode with 16.7 million colors, and thus earned Editors' Choice for 24-bit graphics. The VLB Version was faster than the ISA Version, producing Graphics WinMark scores of 7.4 million pixels per second and 5.9 million, respectively.

The VLB Version also was one of the top performers of the 43 cards we

reviewed. Its 256-color Graphics WinMark scores put it in third-place (trailing only those produced by adapters using the AGC 98032 and Weitek P9000 chips), as was its Winstone score. The ISA Version was a strong performer, too. The boards support 1,600-by-1,200 with 256 colors—the highest resolution of this roundup (the Orchid Celsius/VLB was the only other card to do so).

The Matrox MGA 64-BLT engine, which is coupled with a Brooktree 485 RAMDAC, provides acceleration for common Windows functions at all supported pixel depths and resolutions. These functions include BitBlts (bit-block transfers); pattern and fill accelerations; and dedicated support for 3-D Gouraud shading, z-buffering, and character drawing.

Matrox offers a series of 11 MGA-based cards, ranging from the two we tested to the 4.5MB, \$1,699 Impression Pro. All 11 boards are powered by the company's own 64-bit graphics engine, which can support resolutions up to 1,600-by-1,200. The two boards we tested can support 16.7 million colors at 800-by-600 and 640-by-480, as well as 32,768 colors at 1,024-by-768 and 1,152-by-882 resolutions. At lower resolutions, they offer hardware pans and zooms up to the full area of their 1,600-by-1,200 virtual desktop.

Drivers include Microsoft Windows 3.1, Microsoft Windows NT, MicroStation, OS/2, and Matrox's own DynaView for AutoCAD. Matrox's cards have an on-board VGA chip and pass-through capability for other operating environments, and are available in ISA, VL-Bus, and MCA versions. A PCI version should be available in the third quarter of this year. Drivers for

X/Windows and Silicon Graphics' OpenGL also are about to be released.

All 11 Matrox boards come with an impressive suite of drivers and utilities. A utility called ModeSwitch lets you use hotkeys to change from one resolution or pixel depth to another with-

out opening a dialog box or leaving Windows. PixelTouch, which is also included, uses another hotkey to magnify the area under the cursor by two to

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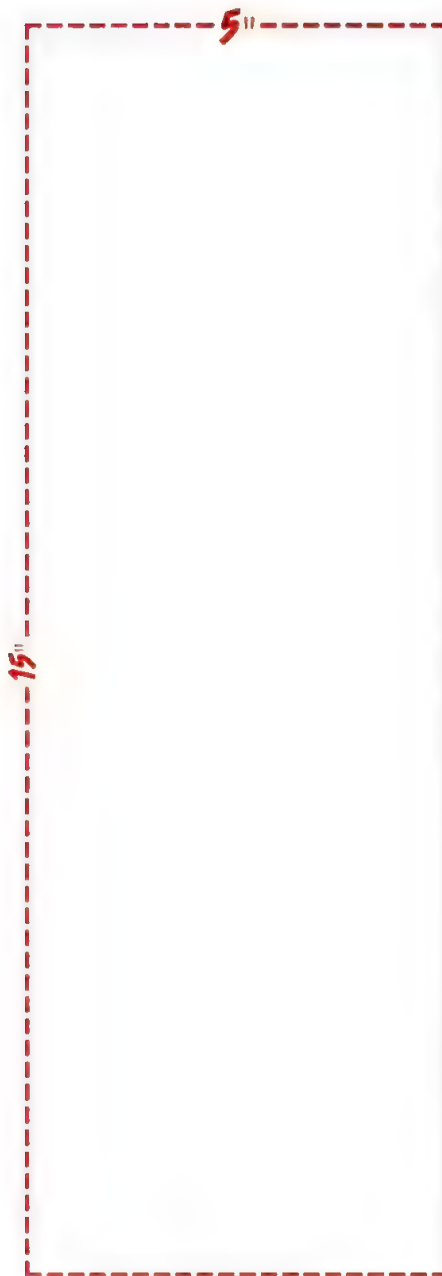
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four times. There are two sets of 8-bit drivers: standard and QCDP (Quality Color Dithering Process). The QCDP driver uses an advanced look-up table to provide almost true-color appearance in 8-bit modes. Although the system slowed when using QCDP, we had a hard time seeing any difference between true-color bitmaps and 8-bit operation, except for a little touch of blue in gray-scale images.

Two utilities have been ported from the older, Matrox Impression line, which is based on the TI TMS34020 chip. For critical applications such as color publishing, you can use a feature called Consistent Color with or without a color probe to fine-tune the contrast, brightness, and color temperature of a system's display. WinSqueeze is an on-the-fly JPEG compression module for Windows that can save a lot of disk space for those working with true-color bitmaps. ClearType, an anti-aliasing font manager for the card, was in final testing and unavailable for our review. It should ship with the Ultima series in October.

The Ultima cards also support live video. They work with the Matrox Marvel to display TV signals (NTSC and PAL formats) on-screen, and to capture 24-bit images from a live video source. A video-encoder daughtercard is planned for release by the end of the year; PCI and VL-Bus versions are slated for the fourth quarter of this year. Without the option to expand, the 2MB version will cost \$599; with the option, its price will be \$699. Increasing its memory to 4MB means a total expenditure of \$999.

Setting up an Ultima card does not require any special DOS device drivers; it uses one IRQ and one 16K address-space setting via a DIP switch that you can adjust while the card is in the PC. All settings can be viewed via a DOS setup utility. Most systems will need some form of video BIOS shadowing. Matrox provides a software driver for machines that don't have built-in shadowing support. We found the Ultima cards to be among the easiest to install of any we have tested.

Technical support is provided via a toll-free number; a Matrox BBS and CompuServe are also available to all users. If you need high-resolution outstanding graphics performance, the Ultimas should fill the bill.

►S3 86C-BASED CARDS

Actix GraphicsEngine

32plus/2MB

Actix GraphicsEngine Ultra VL

Diamond Stealth Pro ISA

Diamond Stealth Pro VLB

ELSA Winner 1000

ELSA Winner 1000VL

Metheus Premier 928-2M

Metheus Premier 928-VL2

Nth S3 Advantage VL

Number Nine #9GXE

Number Nine #9GXE VLB

Orchid Fahrenheit VA/VLB

Volante Warp10LB-2

BY BRUCE BROWN

Of the 43 graphics boards we tested, 13 were based on the S3 86C family of accelerator chips. While some of these boards are bargains, the cards based on this chip family generally proved to be average performers. If speed is your main buying criterion, you should look at boards based on the AGC 98032, Weitek P9000, Matrox MGA, or Tseng ET4000/W32i chips.

Of the five accelerator chips in the current 86C family, only the three models in this review—the 86C801, 86C805, and 86C928—can accommodate 2MB of memory. The remaining two chips—the 86C911 and 86C924—support only up to 1MB of VRAM and are available in ISA, EISA, or VL-Bus configurations.

The 86C801 comes only in an ISA configuration. The 86C805, a 32-bit I/O version of the 86C801, supports local-bus and EISA interfaces. The 86C928 is the highest-powered accelerator chip from S3, offering a maximum resolution of 1,600-by-1,200 noninterlaced, a 64-bit RAM-

DAC data path (versus the 8-bit paths of the 86C801- and 86C805-based boards), and a 135-MHz maximum pixel clock rate (versus the 110-MHz speed of the 86C801 and 86C805). It also supports up to 4MB of VRAM.

The 13 boards in this category included one 86C801-based ISA card, three 86C805-based local-bus cards, five 86C928-based VL-Bus cards, and three 86C928-based ISA cards. The 86C928-based ELSA Winner 1000 offered ISA and EISA interfaces.

Performance among boards with the same chip type varied widely on our tests. According to S3, performance differences among boards with the same video chip, amount of memory, and bus type were most likely due to the video drivers supplied by the board vendors. While S3 does provide drivers with its chips, the board vendors can elect whether or not to optimize these drivers before selling them. A less efficient driver implementation will yield lower performance scores.

The local-bus versions of the boards based on the 86C805 and 86C928 performed better on our AutoCAD and DOS video tests than they did under Windows, but even in these areas the results varied according to the drivers.

S3 86C801

The ISA-bus Actix GraphicsEngine 32plus/2MB (\$249 list) was the only video board that used the 86C801 (the 86C805 is the VL-Bus version of this chip). The GraphicsEngine 32plus is a reasonable choice if you are going to run only Windows applications and want to save money. Otherwise it's not much of a competitor.

The Actix GraphicsEngine 32plus's 45-ns DRAM helped it match or exceed the performance of the three 86C805-based boards on our Graphics WinMark tests; using our 8MB test-bed, the board's scores were 9.1 million pixels per second in 800-by-600 mode with 256 colors, 9.0 million in 1,024-by-768 mode with 256 colors, and 7.0 million in 1,280-by-1,024 mode with 256 colors. On the other hand, the Actix GraphicsEngine 32plus's AutoCAD score (10.6), video score (2,305), 8MB-platform Winstone score (38.0), and 16MB-platform Winstone score (49.8) all were lower than

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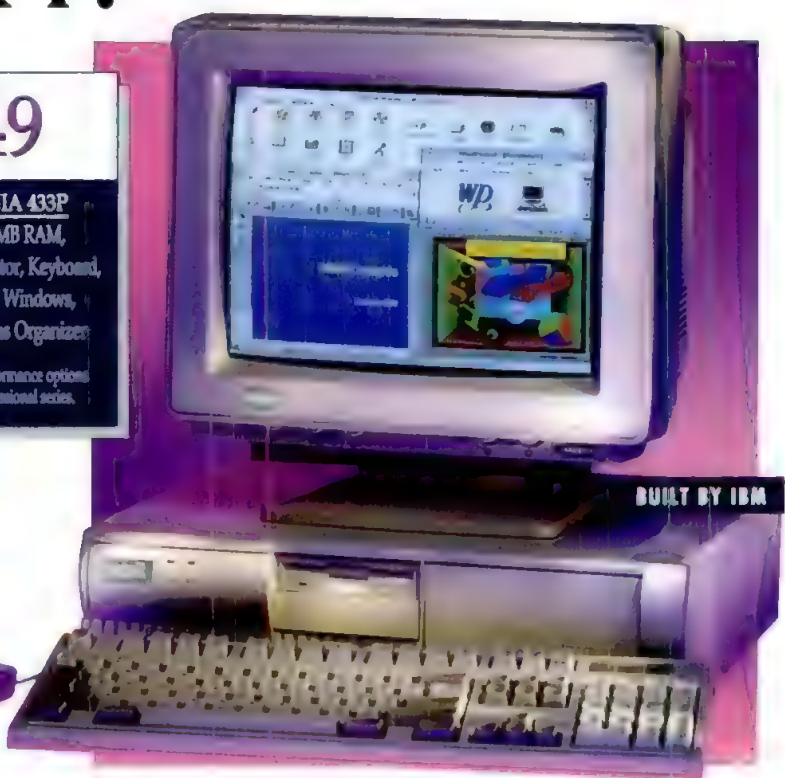
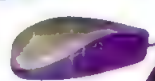
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those of the 86C805-based boards.

As did most of the 13 boards, the Actix GraphicsEngine 32plus came with an easy-to-use driver installation program. The board also comes with a Windows video-mode switching utility that requires you to restart Windows.

53 86C805

The 86C805-based boards included the \$595 Nth S3 Advantage VL, the \$299 Orchid Fahrenheit VA/VLB, and the \$399 Volante Warp10LB-2. With regard to performance and features, we found little justification for the higher costs of the Warp10LB-2 and S3 Advantage VL. The Fahrenheit VA/VLB, however, is a good buy for moderate all-around performance, particularly because of its extra features.

For example, the Fahrenheit VA/VLB was the only S3 board with a voice annotation feature. This board comes with a small microphone and cables, which connect either to the PC's internal speaker or to external speakers. It also comes with Orchid's VoiceNotes and several other voice-based applications, including a talking clock and stopwatch. In addition, the Fahrenheit VA/VLB includes virtual-screen and zoom features, and utilities that let you preview VGA modes and change the refresh rate.

The three 86C805-based boards had varied performance scores, compared with the higher-powered, 86C928-based boards and the entire group of 43 video boards we tested. On the 8MB test-bed system, the 86C805-based boards produced better Winstone scores than did most of the 86C928-based boards (with scores ranging from 39.1 to 40.2). On the 16MB system, the 86C805-based boards produced Winstone scores that were slightly better than the average produced by all 13 boards (with scores ranging from 49.9 to 50.6).

Graphics WinMark scores on the 8MB test-bed were average (ranging from 7.9 million pixels per second to 8.8 million at 800-by-600 with 256 colors, and from 7.2 million to 7.5 million at 1,024-by-768 with 256 colors). The 16MB WinMark scores were consistent with the 8MB tests.

On our DOS video tests, the 86C805-based boards produced above-average results, compared with all 43 boards.

(The S3 Advantage VL had the highest score of the three 86C805-based boards, and the Fahrenheit VA/VLB had the lowest score.) These results suggest that 86C805-based boards, unlike many accelerated video boards that lag in DOS text-mode applications, are a good choice if you use both DOS and Windows applications.

AutoCAD testing revealed the significance of drivers, as each vendor used drivers created by or specifically for the board. The Warp10LB-2 had the highest AutoCAD score of the three 86C805 cards (13.0), outperforming the Fahrenheit VA/VLB (12.3) and S3 Advantage VL (11.1).

The S3 Advantage VL does not have a Windows video-mode-switching utility; you must exit and use the Windows Setup program. The S3 Advantage VL's limited documentation and lack of technical specifications also made its installation the most difficult of all 13 boards. The Warp10LB-2's installation adds a Windows icon for mode switching in its own program group, while the Fahrenheit VA/VLB puts an icon in the Windows Control Panel group.

The S3 Advantage VL also does not support 1,280-by-1,024 with 256 colors, while the Fahrenheit VA/VLB and Warp10LB-2 boards provide 1,280-by-1,024 support at flickering, 45 Hz and 48 Hz vertical refresh rates, respectively. For users with 14-, 15-, and 17-inch monitors, support for 1,280-by-1,024 with 256 colors typically is not a requirement. For users with 19-inch and larger monitors, however, high resolutions are usually desirable.

All three boards switched adequately between Windows applications, although both the S3 Advantage VL and Warp10LB-2 boards made a slight clicking sound and took more than 2 seconds to switch to DOS from Windows.

53 86C928

The local-bus 86C928-based boards included the \$399 Actix GraphicsEngine Ultra VL, \$449 Diamond Stealth Pro

VLB, \$599 ELSA Winner 1000VL, \$578 Metheus Premier 928-VL2, and \$495 Number Nine #9GXE VLB. The ISA-bus 86C928-based boards included the \$449 Diamond Stealth Pro ISA, \$599 ELSA Winner 1000, \$549 Metheus Premier 928-2M, and \$495 Number Nine #9GXE.

Performance scores for the nine 86C928-based boards varied a great deal because of the different bus interfaces and drivers. In no case were these boards consistently high scorers in comparison with the entire group of 43 cards. The Winner 1000 has an EISA bus as well as an ISA connector, so we tested this board in both configurations.

In general, the five local-bus boards turned in higher scores than did the four ISA-bus boards.

The poor performance of the slower VL-Bus boards is a result of their drivers.

Of all the 86C928-based boards, the GraphicsEngine Ultra VL turned in the highest scores, leading all of the boards based on the 86C family. It scored 5,577 on our video test, 11.6 million and 12.2 million pixels per second on our Graphics WinMark tests (in 8MB and 16MB test-beds, respectively), and 52.4 on our Winstone test, using a 16MB test PC. The GraphicsEngine Ultra VL's Winstone score of 39.5 on an 8MB system was also excellent. This board also had high refresh rates (87 Hz in 1,024-by-768 with 256 colors and 74 Hz in 1,280-by-1,024 with 256).

The only test on which the GraphicsEngine Ultra VL trailed the other 86C928-based boards was the AutoCAD test, where its 10.5 score was the second-lowest of all 13 boards in this category.

The #9GXE VLB was the second-fastest local-bus 86C928-based board, with good AutoCAD (13.2), video (5,334), Graphics WinMark (10.5 million and 11.0 million pixels per second), and Winstone scores (36.7 and 50.2 on the 8MB and 16MB test systems, respectively). The 86C928-based VL-Bus boards from Diamond, ELSA, and Metheus had inconsistent and unexceptional test

The performance scores for the nine 86C928-based boards we reviewed varied a great deal because of the different bus interfaces and drivers.

results compared with the other boards based on this chip.

While the ISA boards were generally slower than their VL-Bus counterparts, there were clear winners within the 86C928-based ISA group. The #9GXE and Premier 928-2M were the fastest ISA-bus cards, with the #9GXE having a slight edge. The #9GXE's AutoCAD score (12.3) was high for this group.

The Winner 1000 (with low scores in both ISA and EISA modes) and the Stealth Pro ISA trailed the pack, with the latter board placing last of all the boards in this roundup on five tests. The only bright spots for these two boards were their AutoCAD and DOS video scores, which were midrange for both the group of 13 cards and the entire group of 43.

FEATURES

Video boards should not be judged on performance alone; features should be factored into the equation. The Number Nine boards stand out for their highest-rated ease of installation, which includes a program to install video drivers for Windows applications, as well as a powerful set of utilities that are included with the boards and install automatically.

Number Nine's HawkEye Control Panel is a Windows application suite that includes utilities for changing resolutions, refresh rates, color modes, and the cursor color. It also has a virtual screen and a virtual-resolution utility (which includes several subutilities that let you manipulate the virtual-resolution screen in several ways). The Number Nine boards also have fast refresh rates, supporting 76 to 77 Hz in 800-by-600, 1,024-by-768, and 1,280-by-1,024 modes with 256 colors.

The ISA and VLB versions of the Stealth Pro both come with MacroMedia's Action! multimedia presentation software. These boards also are capable of higher-than-average refresh rates, supporting 1,280-by-1,024 with 256 colors at 72 Hz.

The Winner 1000 and Winner 1000VL use a primitive driver-installation program that eventually installs a convenient mode-switching utility for use in Windows. Unfortunately, if you use the Windows Setup program to select a video mode not supported by these boards (such as VGA) and then try to switch

back to a mode they do handle, you have to reinstall the drivers again.

When using its ISA connector, the Winner 1000 also did not work correctly in 1,024-by-768 mode when we opened a DOS window under Windows; full or partial DOS windows opened and responded to keystroke commands, but no characters were displayed. In this board's favor, the dual ISA/EISA bus flexibility is advantageous if your company has both ISA and EISA machines but prefers to standardize on one video board for inventory and support purposes.

You can plug two, three, or four Premier 928 boards into your PC's motherboard (the only ISA-bus 86C928-based card that lets you do this) as long as the boards have the same memory and BIOS settings. This feature is especially useful in training or demonstration applications.

Based on their test performance, none of the ISA-bus 86C928-based boards are fast enough to merit your consideration if you're looking for a speedy accelerator. The two fastest of the ISA-bus 86C928-based group, the Number Nine and the Metheus entries, are priced similarly to many of the Weitek 9000-based boards, which turned in superlative Graphics WinMark and Winstone scores.

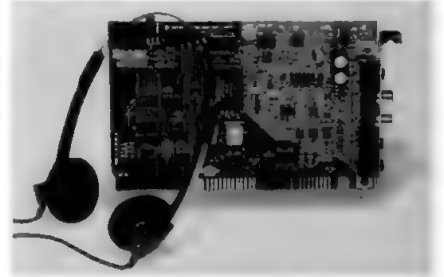
Of the local-bus 86C928-based boards, the GraphicsEngine Ultra VL is the best deal because it has the lowest price of this category (\$399) and the top performance scores. The \$495 #9GXE VLB comes with the most impressive ancillary software, and its Windows utilities are especially impressive.

The ELSA and Metheus boards cost more and are slower than the Actix and Number Nine boards. The Stealth Pro VLB is relatively inexpensive at \$449 and has fairly balanced Windows, video, and AutoCAD results, but it isn't a leading performer if your predominant purpose is running Windows software.

If you're looking for the fastest Windows performance for your dollar, the 86C928-based local-bus boards are the best bet of these 13 boards, but even these are only average compared with other boards in this story. Relative to similarly priced boards based on the Weitek P9000 and AGC 98032 chips, which are much faster under Windows, the S3-based boards are not competitive.

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► TSENG ET4000/W32i-BASED CARDS

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TrueColor/VL/XL2

Sigma Designs Concorde VLB

BY JAMES KARNEY

Conventional wisdom says that to attain real speed, a graphics adapter must use VRAM. The Tseng ET4000/W32i chip shows that conventional wisdom is not always right. A good design can count as much as memory when producing Microsoft Windows accelerators. The three ET4000/W32i-based VL-Bus boards we tested—the \$279 Focus 2 the Max TrueSpeed W32i, \$259 Micro-Labs Ultimate TrueColor/VL/XL2, and \$249 Sigma Designs Concorde VLB—all use DRAM, and all managed to post impressive scores on our benchmark tests. These boards also were at the top in terms of their DOS video scores. Impressive performance at a relatively low price earned these three boards an honorable mention.

All three fared well on our Graphics WinMark test suite at 800-by-600 with 256 colors on the 8MB platform. The Ultimate TrueColor and the Concorde VLB tied for ninth place, with a score of 12.1 million pixels per second, followed by the TrueSpeed W32i, with a score of 11.6 million. For the same tests on the 16MB test-bed PC, the TrueSpeed W32i moved up to ninth place, with a score of 12.4 million, while the other two tied for tenth place, producing 12.3 million.

The ET4000/W32i-based cards also posted excellent Winstone results. The Ultimate TrueColor was third among the 43 cards, with a score of 40.5. The Concorde VLB was sixth, with a 40.3 score,

and the TrueSpeed W32i was twelfth, with a score of 39.9.

As a group, these three boards came in fifth in terms of their average benchmark test scores, keeping pace with all but the top-tier cards with AGC 98032, ATI mach32, Matrox MGA, and Weitek P9000 engines. For those looking for speed on a budget, these ET4000/W32i-based cards may be your ticket to the races. But you may not get a front-row seat: They don't support the higher resolutions and color depths that the VRAM leaders do.

For example, the Ultimate TrueColor can't do 24-bit color at 800-by-600 resolution, and its maximum is 1,024-by-768 with 256 colors. At this last resolution, the screen flickered noticeably. In addition, the manual was weak, and there was no Windows installation utility. We hope that these shortcomings will be amended as the product matures. For those users requiring VGA pass-through, the Ultimate TrueColor lacks a connector for this feature. On the plus side, the Ultimate TrueColor produced good benchmark test scores and produced good images (except for the screen flicker).

The Concorde VLB had a simple Windows installation routine, and it supports 1,280-by-1,024 with 16 colors. However, there was screen flicker at 640-by-480 with 24-bit color. This card also came with a poor user manual. The Concorde VLB has limited refresh rates, supporting 56 Hz, 60

Hz, and 72 Hz only.

The TrueSpeed W32i posted very good scores on our benchmark tests, and it supports 1,280-by-1,024 with 256 colors. The install routine does not properly prompt you for the next disk, and there is no dedicated Windows install utility. The software bundle includes a reduced feature copy of WinRIX, but you won't be able to use it in true-color mode at resolutions above 640-by-480. As with the other two ET4000/W32i-based cards, the manual left a good bit to the imagination. While it included a jumper chart, there were

some jumpers that were not listed. But again, these are new products, and we hope the documentation will improve.

Tseng Laboratories has supplied a lot of vendors with VGA chips, and there are many drivers that are sold with the ET4000/W32i. These include AutoCAD, GEM, Lotus 1-2-3, Microsoft Windows 3.1, WordPerfect, WordStar, Ventura Publisher, and an 8514/A emulation.

These ET4000/W32i-based cards offer an interesting approach to performance on a tight budget. The three vendors' products we examined show that the chip can perform well in Windows and DOS modes, but these cards are not as versatile and feature-rich as others in this review. These boards are a good buy for budget-minded users who want fast video performance within the cards' supported resolutions and color ranges. Better manuals and installation routines would go a long way toward making the engine even more attractive.

► WD 90C33-BASED CARDS

Western Digital Paradise

Accelerator VL Plus

BY JAMES KARNEY

The Western Digital Paradise Accelerator VL Plus—which is based on the company's own WD 90C33 chip—is a decent Microsoft Windows performer, but it lacks the punch for serious graphics or CAD applications. This board produced respectable Graphics WinMark scores, and it posted excellent Winstone results as well. Its AutoCAD times were its sore spot; on that suite of tests, it tied with the Genoa WindowsVGA 24 Turbo for last place, with a score of 10.0.

The Paradise Accelerator VL Plus handles 24-bit color only in 640-by-480 resolution, and it supports 1,280-by-768 resolution with 256 colors only in interlaced mode (resulting in noticeable screen flicker). The board comes with 1MB of DRAM standard, and we tested it with an extra megabyte installed. Drivers for AutoCAD, Lotus 1-2-3, Microsoft Windows 3.1, and WordPerfect are provided.

The board's Winstone score of 41.5 on an 8MB test-bed PC was second only to the Appian Renegade 1280/V's 42.9, and its 52.1 score on our 16MB test-bed PC was

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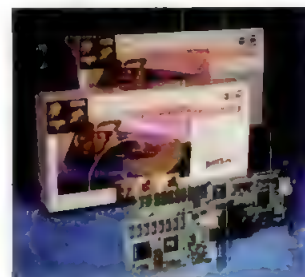
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close to the top scores. The card produced a Graphics WinMark score of 10.9 million pixels per second in 800-by-600 with 256 colors and 10.6 million in 1,024-by-768 with 256 colors. Those scores put it in seventeenth and thirteenth place among all 43 boards in this story. The card's DOS video score was above average, at 3,772.

The Paradise Accelerator VL Plus provides a special control panel within Windows that can be used to change resolution and color depth, but you must exit and restart Windows before the new settings take effect.

One drawback of the card: In some modes, you must reset jumpers and the card's DIP switch to change refresh rates. Most cards today enable you to do this with software commands. The board's documentation, however, is well organized and easy to follow.

At \$299, this card is a relative bargain for low-demand users, but for true Windows acceleration and AutoCAD performance, you may want to move upscale a bit.

► WEITEK P9000-BASED CARDS

Advanced Integration Research

Star2000

American Megatrends

FastView VLB



Cardinal WarpSpeed

Diamond Viper VLB

BY JAMES KARNEY

In terms of average benchmark test performance, the four boards based on the Weitek P9000 chip were second only to the Appian Renegade 1280/V. But these boards had the edge in terms of their true-color capabilities, supporting 800-by-600 resolution with 24-bit graphics. The Appian boards do not; they support 640-by-480 with 24-bit color.

Although performance was basically equal among the four P9000-based boards, our Editors' Choice award went to the \$599 WarpSpeed because it had either more features, better construction, or more VGA memory than the \$385

FastView VLB, \$475 Star2000, and \$499 Viper VLB. The WarpSpeed, however, was the most expensive of the P9000-based boards, and for general Microsoft Windows applications, users could be satisfied with one of the lower-priced cards that received honorable mention.

The P9000 is a 32-bit graphics adapter engine that was originally designed for dedicated workstations, and it has power to burn. It provides a hardware cursor, BitBlts (bit-block transfers), and acceleration for line drawing, pattern and polygon fills, and clipping. The engine also supports linear addressing, which offers fast data transfer for multimedia applications.

At 800-by-600 with 256 colors and 8MB of RAM, two P9000-based boards produced Graphics WinMark scores that were better than those of the Appian Renegade 1280/V. The WarpSpeed and the Star2000 tied for first place, producing 15.8 million pixels per second; they outperformed the Renegade 1280/V, which scored 15.4 million. Overall, scores for the boards based on the Appian AGC 98032 and the Weitek P9000 were extremely close. The Renegade 1280/V's 8MB-platform Winstone scores were best, while the P9000-based board's were third, fifth, sixth, and seventh. The 16MB-platform Winstone results were similar. DOS video scores for the P9000-based boards were passable but not sterling.

The AutoCAD scores for these cards varied widely. The Viper was the best performer, taking seventh place. The WarpSpeed placed fifteenth, the FastView VLB twenty-second, and the Star2000 twenty-eighth.

All of these boards except the Viper use the Panacea CAD driver. The Viper is shipped with SoftEngine 386, by Vibrant Graphics, which we believe accounts for its better CAD performance.

These CAD scores emphasize the importance of matching your graphics requirements to an adapter's strengths, rather than basing your decision on raw performance numbers alone. The chip is

not the only factor that determines performance. How well the board's design and drivers are tuned also has a major impact on real-world performance and how well the power of the engine is used. All of the cards in this review will please the average Windows user.

In terms of functionality, there are very few significant differences among these four boards. All are designed for VL-Bus operation. All offer Windows drivers based on core code supplied by

Weitek. With 2MB of VRAM, coupled with the Brooktree 485 RAMDAC, the cards can provide 16.7 million colors at 800-by-600 and 256 colors at 1,280-by-1,024. This is fine for Windows users who don't do much graphics-intensive work, and the engine and driver provide

speed to spare for the kinds of tasks those users are likely to perform.

All four cards offer on-board VGA via another Weitek chip—the Weitek 5186. The FastView VLB and WarpSpeed offer 512K of dedicated VGA DRAM; the Viper and Star2000 supply 256K. If you use many DOS applications and want VESA-approved refresh rates, the Star2000 and Viper may not provide enough memory. On the other hand, you may not have to worry about this for most common applications. There are special drivers for GEM, Lotus 1-2-3, Ventura Publisher, and WordPerfect available for the P9000 chip. The Viper also ships with a copy of MacroMedia's Action!.

If you want to use a dual-display setup or a second VGA card, only the Star2000 is equipped with a VGA connector. It also comes with a Windows mode-switching feature. The four cards come with driver-installation software and were easy to install.

The P9000 is solidly designed, and these four cards are well suited for the average Windows user who wants clean, crisp performance. Those who focus on graphics or CAD, or those who want slick extras such as anti-aliasing fonts, may want to look at other cards.□

*The P9000 is a 32-bit
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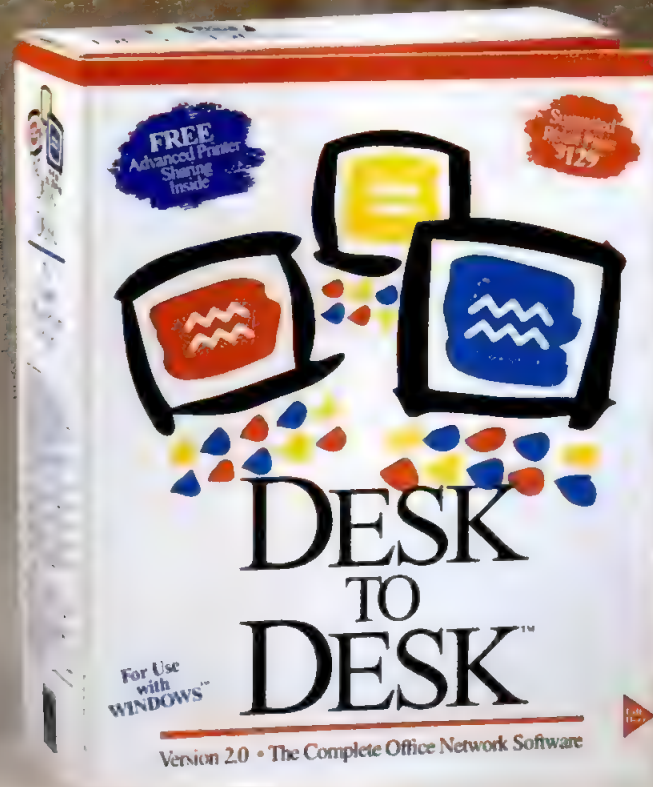
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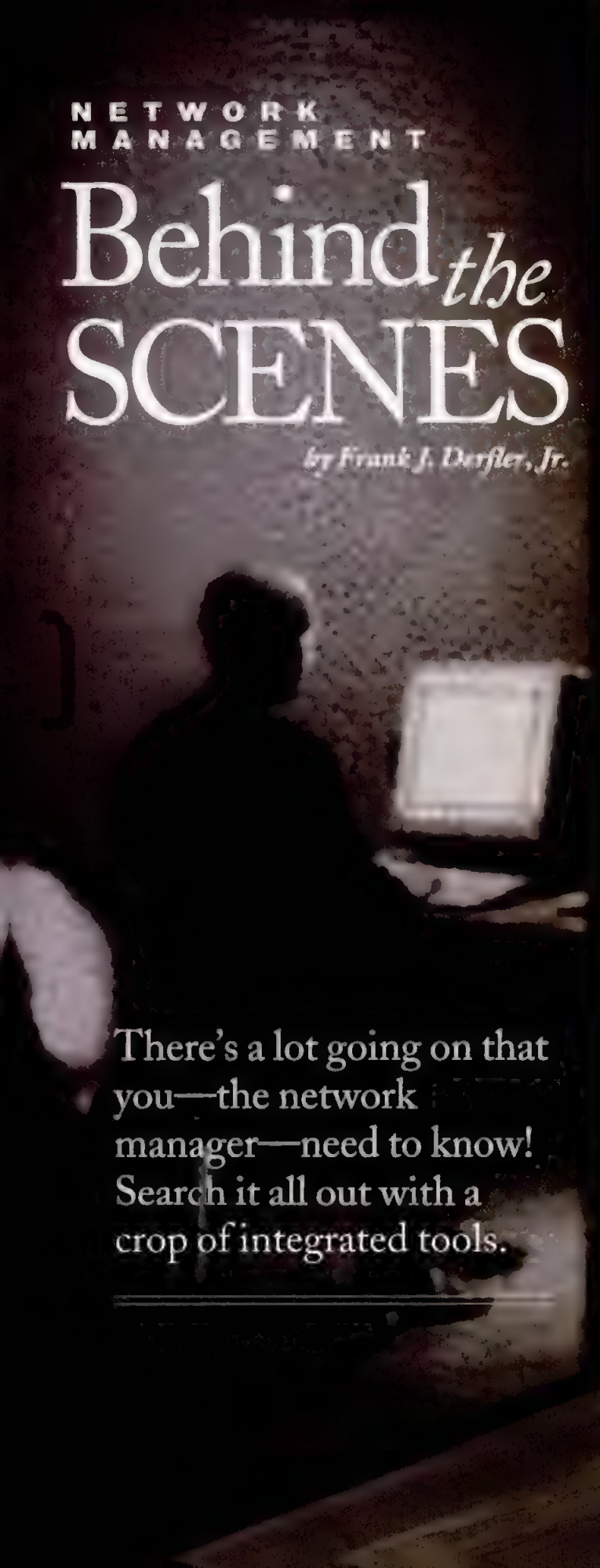
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NETWORK
MANAGEMENT

Behind *the* SCENES

by Frank J. Derflet, Jr.



There's a lot going on that you—the network manager—need to know! Search it all out with a crop of integrated tools.

Photograph by William Duke

Networking

As the manager of your company's mission-critical network, you need a reach that extends across the cabling into each node on the LAN to track what's going on. You'd like a detailed knowledge base, real-time updates on status and operation, and warnings when things go clunk in the night. Because your needs are so diverse, the various network management software packages on the market attempt to fill every niche. This diversity makes network management an amorphous world that's difficult to navigate.

We wish we could tell you that you can start with just a little network management and then gradually increase your investment in a linear fashion. Unfortunately, some paths are dead ends—giving you only scattered capabilities before coming to an abrupt halt, and others can simply take you off course.

We looked for vendors offering more than one management utility—lines of products—sold separately or bundled, that are integrated so they can take you beyond hit-and-miss management. We were searching for a level of integration in which each product in a line can pull information from another, so that the packages work together to deliver to the LAN manager a cohesive tool set.

We found in the group of products we reviewed that "integration" today can

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Network Management

mean a common database or a common interface or management program or even just a single console program that ties together the reports from isolated programs. But we also discuss the work of some groups looking to consolidate the integrated approach, and we include sidebars on a few products not yet shipping that represent the future of truly *integrated* network management.

The network management landscape includes 15 to 20 islands of utilities (some would argue more). But we landed on five basic areas that make up the bulk of LAN management: inventory management, client PC monitoring, server monitoring, traffic monitoring, and reporting and notification. We focused on the largest market share by only including products that work with NetWare (but note that some of these do *only* work with NetWare—a limitation administrators of mixed OS environments must consider). We reviewed products or families of products from Brightwork Development Corp., Cheyenne Software, Frye Computer Systems, Horizons Technology, Intel Corp., LAN Support Group, Micro-

com, Network Computing, Saber Software Corp., Shany, Touchstone Software, Triticom, and XTree Co. Some of these products cover only a few of the five areas, others cover more.

As we mapped the network management landscape, we found signposts erected by Novell, the Desktop Management Task Force (DMTF), the Internet Engineering Task Force (IETF), IBM, and other organizations. These signposts point to comprehensive systems of standards for network management. Some of these territories are uncharted and others are expensive to travel.

NETWORK MANAGEMENT IS...?

So how do these programs help you manage a network? Basically, they provide information you can use to make decisions. The utilities in NetWare give you a lot

of data about the condition of the server. MONITOR.NLM provides detail, in tabular form, about the status of the processor, disk drives, cache, and I/O ports. If you are one of the few who implement the NetWare Accounting utility, you can

get some information, after the fact, about what people do with the file server. The server will tell you immediately about some problems; for example, a disconnected cable or a router error. But none of these utilities provide a good baseline of data for making budgeting and resource manage-

ment decisions, and they do a poor job of helping you troubleshoot.

Inventory management programs help to prevent unauthorized "borrowing" of equipment and even track the versions of programs running in each PC. Programs such as Brightwork Utilities for NetWare, Frye Node Tracker, Horizons'

The network management landscape has 15 to 20 islands of utilities (some would argue more).

HIGHLIGHTS

Network Management Software

NETWORK MANAGEMENT encompasses a formidable range of utilities and tasks. In selecting this group of vendors and packages, we looked for lines of products (either bundled or sold separately) that performed some combination of tasks in five principal areas: inventory management, client PC monitoring, server monitoring, traffic monitoring, and reporting and notification. Numerous other categories fall under the head of network management, and most of the vendors in this roundup offer products capable of performing tasks in many more areas than these five.

WE WERE LOOKING in particular for lines of products that were integrated in their approach to sharing acquired, accumulated data among their respective utilities—usually through a common database. We noted packages that

could create a database and develop a store of knowledge about network hardware and software. We also looked for packages that could build an event database.

WE TOOK SPECIAL NOTE of reporting and notification abilities; every LAN administrator would like to have notice of preset thresholds giving way or major events occurring before disaster actually strikes. Some of these packages will communicate through e-mail or even your pager.

A FEW MORE SOPHISTICATED approaches are now in use or are under development. The best known and most established is the Simple Network Management Protocol (SNMP), originally developed by the Internet Engineering Task Force for managing networks based on Internet's TCP/IP

protocol. SNMP is now in Version 2 and continues to garner wide-ranging support among hardware and software vendors alike (although it started out aiding in the managing of routers, bridges, and hubs).

PERHAPS MORE SO in network management than in other segments of the PC market, vendors attempt to differentiate themselves by packaging their own special mix of products—in this case, network management utilities. This makes trying to distinguish between packages tougher on the buyer. Most administrators start with the need to procure basic inventory management and go from there. But if you also plan to have all of your hardware- and software-management tools work together, you're more likely to succeed in managing your network—rather than having it manage you.

LANauditor, XTree Tools for Networks, Saber LAN Workstation, and Intel's LANdesk Manager—in fact, most of these products—inventory and report the contents of each client PC regularly, typically at network log-on. The software can flag changes and generate reports so you can easily find, for example, everyone on the network running DOS 3.3.

Traffic monitoring programs count the frames of data as they cross the network and identify the source and destination of each frame. You can set alarms so the program immediately tells you about a jabbering Ethernet adapter or a broken cable segment. These products are particularly useful in troubleshooting cable and adapter problems.

Every administrator knows that nothing is more frustrating than intermittent problems on a PC. Often it turns out that problems that look like a hardware fault are caused by software conflicts or misbehaved programs. Client PC monitoring programs, such as Shany AlertView, allow you to take immediate action to find the cause of problems. They reside in the PC and monitor applications. In the event of an abnormal termination or operation, they generate an alert message that, in the case of AlertView, even makes suggestions regarding the cause of the problem.

Server monitoring capabilities, included in XTree Tools and Frye NetWare Console Commander, among others, present the same data found in CONSOLE.NLM, but they keep a history, help spot trends, and sound alarms when certain parameters—such as the percentage of disk utilization or bad packets received—exceed limits you set.

Updating application software is a tedious job. Often it involves physically moving from PC to PC with a box of floppy disks. Programs such as Frye's



EDITORS' CHOICE

• The Frye Utilities for Networks

In seeking an Editors' Choice winner, we looked for integration of a rich set of network management utilities that performed well individually and as a group to provide a comprehensive management solution. As evidenced by the support we saw for the Simple

Network Management Protocol (SNMP), an integrated solution is where network management is heading. A utility should be able to share its data with other utilities to give the administrator a rich, flexible set of data for analysis—especially when it's within a vendor's set of products (or a tool within one package). A common interface is also important.

Frye Computer Systems has carried this approach the farthest, shining in the integration of its rich utilities. And Frye's six products—LAN Directory (LAND), NetWare Console Commander (NCC), NetWare Early Warning System (EWS), Frye Utilities for Networks (FUN), Node Tracker (NT), and Software Update and Distribution System (SUDS)—form a comprehensive suite of packages that gives LAN managers everything they could ask for.

On the simplest level, LAND and SUDS share a common database. More impressive is the way EWS works with NCC to determine prob-

lems via thresholds and correct them by updating the appropriate software or configuration files. In most cases, you can switch from one Frye product to another without exiting and even continue to view the same node when switching from, say, FUN to LAND. This seamless integration makes the broad set of products intuitive and easy to use.

Frye's products also work on a range of operating systems: All work on NetWare, and LAND and SUDS also work on Banyan's VINES, Microsoft LAN Manager, OS/2 LAN Server, Pathworks, and StarLAN.

Deserving of honorable mention, XTree Tools for Networks provides some portion of Frye's functionality (and its look and feel even resembles Frye's) at a much lower price: \$695 compared with almost \$2,900 for Frye's complete suite. Unlike Frye, however, XTree's utilities come in a single product, which requires a 7K TSR, and does not include a built-in reporting engine.

Software Update and Distribution System automate the process.

Today networks grow and get more complicated all the time. Network managers need these and other tools to keep

ahead. Some utilities perform other tasks, including network mapping and virus checking. Network maps, delivered by VisiNet (see our sidebar), provide an illustrated picture of what nodes are on which network segments. Virus checking, which several reviewed packages offer, scans files for virus signatures as they move into and out of the server.

So, you've got dozens of choices in network management. You can put together your own library of packages, and some administrators are pleased with the "suites" they accumulate. Here, we've focused on vendors who seem headed to-

Our Contributors: FRANK J. DERFLER, JR., is senior networking editor of *PC Magazine*. KEVIN BACHUS is a free-lance writer and former editor of *Corporate Computing*. PADRAIC BOYLE is a network project leader for Ziff-Davis Publishing Co. and a frequent contributor to *PC Magazine*. MAX SCHIRESON is a senior project leader and MICHAEL BLAKELEY and RYAN TABIBIAN are associate project leaders at ZD Labs. ANDREW C. KANTOR is a staff editor, ADAM A. HICKS is an editorial researcher, and CONSTANTINE FOTOPOULOS is a support technician at *PC Magazine*. GAIL SHAFFER was the associate editor in charge of this story, and RICHARD BRADY was the project leader.

Suitability to Task: Network Management

In testing network management tools—particularly with an eye to the extent of integration—we looked for a product, or suite of products, that not only provided a LAN manager with vital information about the network, but had robust notification, reporting, and troubleshooting tools.

Client PC and inventory management The most elemental component of network management is the tracking of what's in the client PCs on the LAN. We determined if a package polled clients for both hardware and software information, how detailed the information gathered was, and if it flagged differences from polling to polling. This task is most useful for tracking machines for hardware compatibility and making sure everyone has the correct version of standard software. It's also critical in making sure equipment has not disappeared.

On the client side, the software should determine the client address and the type and ID of the network interface card, as well as the driver types, versions, and the interrupts used. It should also keep track of which DOS and IPX versions are running. A better package will allow the administrator to manage the software on the servers and clients, noting which users have what software, allowing network-wide upgrades and, preferably, keeping track of license agreements.

Server and traffic monitoring On the server end, better products will note configuration changes, hard disk size, available space, and defective blocks. The products should track overall network throughput, the performance of the cache, and information about the packets—their physical receive size, whether they overflow, and if any are discarded.

ward a more integrated approach. But where does the field of network management go from here?

MANAGEMENT ARCHITECTURE

Committees and companies abound in proclaiming standards for just about every aspect of computing, especially networking. The most impressive grand management strategies come from IBM, the International Standards Organization (ISO), and the IETF. These standards describe all-encompassing and expensive architectures with many features for WAN management.

SUITABILITY TO TASK				
Product Name	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	☒	☐	☐	☐
Server and traffic monitoring	☒	☒	☐	☐
Reporting and notification	☒	☒	☒	☐
Integration	☒	☒	☒	☒

Reporting and notification No LAN administrator wants to learn about problems after they've occurred. A good tool will notify the manager of impending trouble spots. Better management packages will have more configurable thresholds for managers to set, and more options for notification when those limits have been exceeded. Notification by e-mail, fax, or beeper is integral to a well-designed tool, but so is a powerful reporting engine—one that can create reports on the fly and sort the data to suit the administrator's needs, presenting it numerically or graphically. Periodic reports and log files are also desirable, and top-notch programs will also compile a knowledge base of information gathered over time. Managers concerned with security—and who isn't?—will want a package that notes password violation and off-hour log-ons. They'll also want to know when two stations are logged on with the same name at the same time.

Integration We focused in this roundup on how well the packages in a suite (or the individual utilities in a single package) work together, because this capability makes for more flexible, proactive network management. A good package will share information with its sibling products on the fly, while keeping the underlying database transparent to the LAN administrator. There shouldn't be a price to pay for integration.

NetView was developed by IBM, and 3Com and is generally the most expensive of the three to implement. It requires a lot of computing power, and you'll typically find NetView only in "true blue" organizations running IBM hardware. IBM also extends NetView to the desktop with a series of products.

The Common Management Information Protocol (CMIP) was developed by the ISO and is popular in Europe as well as at very large sites. Digital Equipment Corp. has an extensive family of products called Polycenter based on the ISO and Open Software Foundation (OSF) proto-

cols—although it also supports other protocols. In North America, CMIP and the ISO concept face competition from older, proven standards are backed by time-tested products. One standard that has commanded a large share of the market is the Simple Network Management Protocol (SNMP).

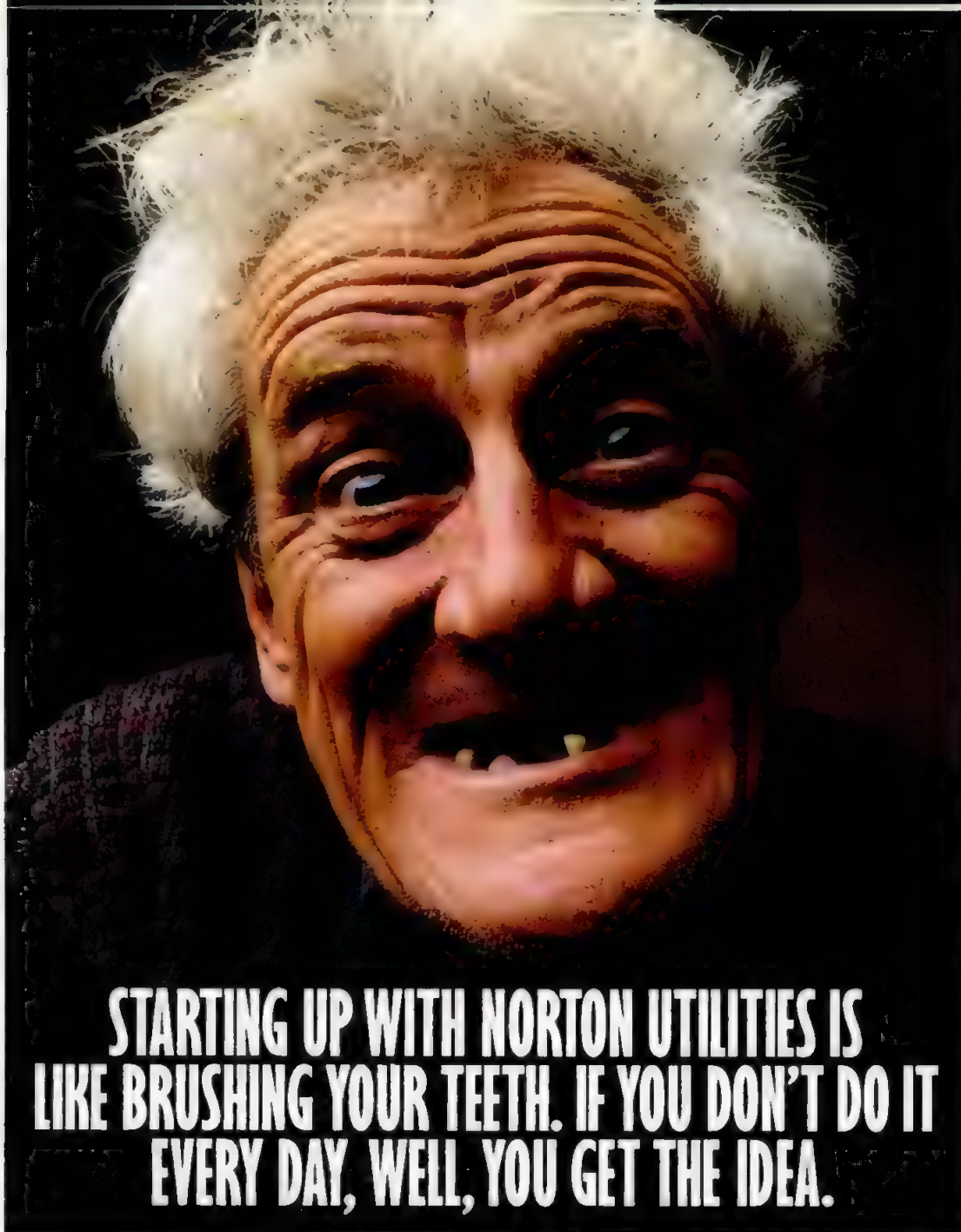
SNMP, the best known and best implemented of all network management protocols, was defined by the IETF for managing networks based on the Transmission Control Protocol/Internet Protocol (TCP/IP). SNMP provides a common format used by network devices such as routers, wiring hubs, and bridges to communicate defined sets of management data. The SNMP query and reporting process uses a network communications protocol from the TCP/IP protocol stack instead of the IPX or NetBIOS used in Novell and many Microsoft-derived networks. This use of TCP/IP complicates, but does not preclude, the integration of SNMP into many LANs.

All network management systems have basically the same architecture. An agent in a specific network node gathers and records data and reports it, either on demand or as a special message call and alert, to a central program or management console that consolidates and displays the data from many agents.

The agent often consists of a special-purpose processor, typically in the 80186 class, located in each managed unit—although it can simply be a program running in a multitasking environment such as a file server. The processor holds data in its RAM until it is polled.

Under SNMP, the format for the stored data is called a management information base (MIB). The MIB stores traffic, equipment, and error-log information. Many companies have extended the standard SNMP MIBs to include unique fields of data and reports. Keeping these MIB extensions current is a new chore for administrators that comes along with the benefits of SNMP management.

The management console software can run on a computer using Microsoft Windows or on a Unix-based workstation. This software polls each agent over the network cable for pertinent information regarding the individual nodes on the network. It looks for error messages



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and other statistics. It gathers these statistics from all of the agents on the network and then it presents the data in a meaningful format.

Management console displays typically include multiple bar charts and graphs and can provide various levels of real-time and historical data. HP's OpenView, running under Unix, is the most popular management console software (but VisiSoft's VisiNet is an excellent and much less expensive Windows-based SNMP management console).

DOWN TO THE DESKTOP

NetView, CMIP, and SNMP are the grand strategies for network management, but other organizations have developed smaller scale plans. The DMTF, an organization of more than 300 vendors, is completing a Desktop Management Interface (DMI) for network management systems. The DMI will provide a sublayer of management integration below the grand strategies. DMI will define how an agent interacts with devices, components, and programs inside a PC to gather and report detailed information. Companies that support DMI, such as Intel, use either NetBIOS or IPX to bring this information to a central management station.

The IETF also recognized this same need for simplified desktop management and has developed an SNMP Host Resources MIB. This MIB defines a common set of objects such as drives, adapters, and applications that a PC can manage. Among the products in this article, Microcom's LANlord, for example, can read the Host Resources MIB, but uses TCP/IP protocols to do it.

Although it makes sense to integrate the DMI with the Host Resources MIB, progress in this area has been slow. Early DMI programs, such as Intel's LANdesk Gateway/SNMP, consolidate DMI data and make it available to SNMP management consoles. Other vendors will follow the same path. For example, LANlord has strong desktop management data-gathering capabilities and can, through an optional proxy agent, relay the desktop data to SNMP management consoles.

NOVELL'S NMS

Novell's NetWare Management System (NMS) doesn't fit neatly into a specific

■ How We Tested

No two networks are the same. Likewise, no two network administration jobs are the same. Network management software is therefore designed with a wide range of tasks in mind. Vendors even design different configurations targeted toward different customer needs. We paid particular attention to the integration of the different capabilities among the products. We noted how well the different parts or different products from the same vendor worked together. Was all the information gathered by one module available to other modules?

Our test-bed consisted of eight PC clients on two servers, one running NetWare 3.11 and one running NetWare 2.2. We included NetWare 2.2 because a large number of sites still haven't upgraded from 2.x; we considered it important to test new products with an installed base of older hardware and software. The two NetWare servers were on an Ethernet backbone; the 3.11 server supported four PCs on Token-Ring, while the other four clients connected to the 2.2 server via Ethernet. Novell's router software enabled all the clients to log on to either server.

We began by testing inventory management. We changed the amount of RAM in a machine and checked to see if the network management package reported it. We also de-

termined whether the products could check and identify software versions, and whether they could send an alarm to the administrator if a user had an old version of DOS. Could the network management software correctly identify the make, model, and CPU of the client PCs? Could it correctly identify the cards installed?

We also used packages to monitor servers: Could the software send an alert when the server disk was almost full? Could the network administrator set levels for alerts and set multiple levels of alerts (for example, if a critical threshold of bad blocks was reached)?

Another area we looked at was software distribution. Could the network management package automatically distribute software updates to clients? How much control did the administrator have when these scheduled updates took place? Could the software update CONFIG.SYS, AUTOEXEC.BAT, and other system files? Did the package notify users before it installed software or modified files on their systems?

We also considered each package or line of packages from a general standpoint. Did it require TSRs on the clients? How much memory did it use? How much disk space did it require on the server? How difficult was installation? What sort of reports could it produce?



network management category (not that they're all neat). NMS is, in the minds of some, an internetwork architecture and a product that competes with and can replace a combination of the SNMP architecture and products such as SunNet Manager and HP OpenView.

Some vendors in this story regard NMS as a system of services and interaction points for their products. Others see NMS as another sublayer of LAN management under the grand strategies of internetwork management. So you'll see products here that operate with and also compete with NMS. You'll have to exam-

ine the extra management detail and functionality carefully, particularly—if it concerns your network—the coverage of NetWare 2.x that NMS lacks, which these products bring to the system.

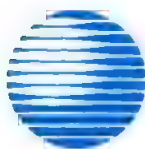
Network management products are a great help to a busy LAN administrator. And integration has made sense every step of the way in networking—since the term was first used to describe how the most basic hardware pieces should work together—something we take somewhat for granted today. As we've seen in all areas of networking, integration of software is much trickier.

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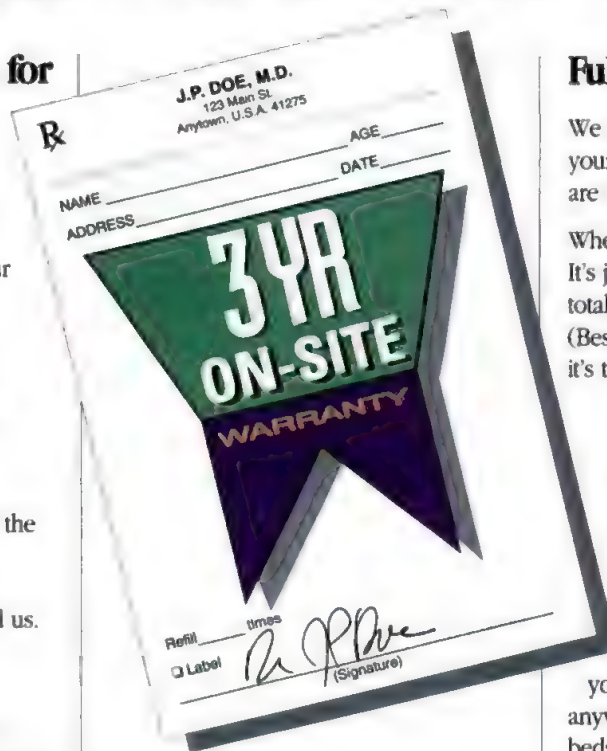
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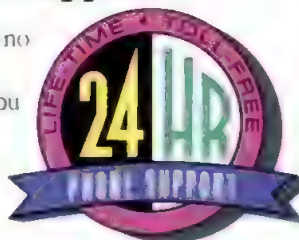
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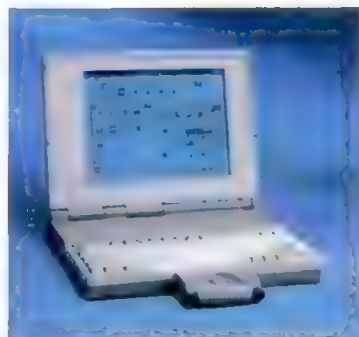
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Brightwork Development Inc.

Brightwork Utilities for NetWare

BY KEVIN BACHUS

Brightwork Development's Brightwork Utilities for NetWare, Version 1.0, handles the integration of its components better than most. It combines five modules—client inventory, license metering, remote control, server monitoring, and printer management—all under a common interface. Its major limitation seems to be that it runs only on NetWare networks.

Brightwork Development takes its suite one step further than most by ensuring data interchangeability among modules. Although other products offered better individual components, access to all five tools from one Windows-based console gives this product a distinct edge.

It consolidates 50-user versions of the company's flagship management product under a common shell called the LAN

Tachometer, a Windows-based dashboard of network statistics that also serves as the program's main console.

LAN Automatic Inventory (LAI) audits both hardware and software elements of each client and records the results in a central database from which it

can generate reports and answer queries. LAN Server Watch provides a remote view of server performance, including cache hit percentages, memory utilization, and security violations. SiteLock is a full-featured software metering and virus protection product, and NETremote+ offers remote control of any client from a central console.

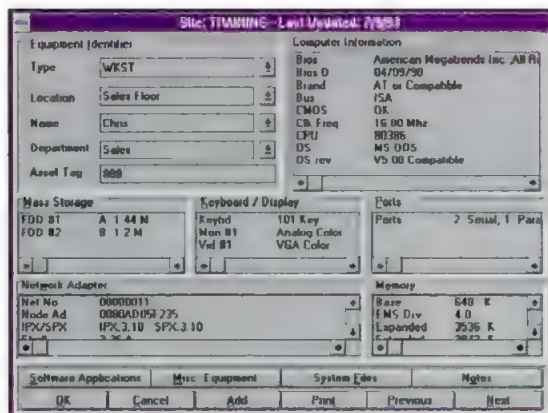
LAI was the most impressive of the modules. Like most other packages, LAI added an inventory application to the network log-on script and let us collect data hourly, daily, weekly, or monthly, from each computer on the network. Brightwork says the system can accurately recognize nearly 2,000 applications by name and version number, and we were able to add our own applications to the system's database. The program, however, really shone when asked to report any configuration

changes as soon as they were detected.

LAN Server Watch was also extremely easy to use, though not as comprehensive as LAI. We were able to set alerts for more than 30 indicators and receive notifications via e-mail, pager, or NetWare's SEND command. However, we found it difficult to monitor multiple servers through a single interface.

NETremote+ performed adequately. We were able to take over the keyboard and monitor of any logged-on client and perform simple file transfers between the console PC and the remote station. Unusual and much appreciated was NETremote+'s array of diagnostics, which can be launched from the administrator's console without taking control of the PC. Although the tests seize the client PC momentarily, they can be performed quickly and relatively inobtrusively.

SiteLock rounded out the suite with an extensive array of application monitoring features. Through an interface similar to NetWare's SYSCON, we were able to associate a maximum number of



On a single screen, Brightwork Utilities for NetWare can provide hardware and software information for any network client.

users with each application on the server. When a user attempted to access an application, but would exceed the limit, the system displayed a warning message and denied access. SiteLock, however, was unable to monitor the use of applications run from a local hard disk.

Finally, SiteLock protects against viruses by running a CHECKSUM on each application before execution and comparing the result to a previously stored value.

Although the product can monitor both Mac and PC clients, it cannot stretch throughout the enterprise. Brightwork Utilities is best suited for small- to medium-size LANs. And at \$495, the program is a bargain for that market.

Cheyenne Software Inc.

Monitrix

BY PADRAIC BOYLE

For a low-cost network-management package that determines server and client configurations with little overhead, look to Monitrix, Version 2.2, from Cheyenne Software. It can also collect data to help determine a LAN's health and stability,

SUITABILITY TO TASK				
Monitrix				
	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	○
Server and traffic monitoring	●	●	●	○
Reporting and notification	●	●	●	○
Integration	●	○	○	○

FACT FILE

Brightwork Utilities for NetWare, Version 1.0

Brightwork Development Inc.,
766 Shrewsbury Ave., Jerral Center West,
Tinton Falls, NJ 07724; 800-552-9876,
908-530-0440; fax, 908-530-0622

List price: 50-user network, \$495; 100-user network, \$1,695; 250-user network, \$2,995

Requirements (server): 386SX-based PC or better, 2MB RAM, 10MB hard disk space, Microsoft Windows 3.1, NetWare 2.x or 3.x.

In short: Good integration and a low price are hampered by lack of wide-area network support



ON READER SERVICE CARD

■ SNMP: Living Up to Its Name?

by Michael Blakeley

Network management can be a costly and time-consuming endeavor that can impact your success as a network administrator. So why add to the complexity by considering the Simple Network Management Protocol (SNMP)?

SNMP was designed for the Internet, a vast expanse of computers linked across the globe via TCP/IP. Early on, the Internet consisted mainly of educational and government institutions.

But SNMP soon became the sine qua non of corporate networks as well. With its ability to pull data regarding hubs, client systems, and routers across increasingly heterogeneous networks, SNMP found its way onto the desktops of many corporate WAN managers.

In the second quarter of this year, standards for Version 2 of SNMP were

released. SNMP 2 adds manager-to-manager communications, security features (including user authentication and DES encryption), and bulk data retrieval, but it maintains backward compatibility with older SNMP agents. Transport mappings are now specified for AppleTalk, IPX/SPX, OSI, and TCP/IP, allowing PCs to be managed without a TCP/IP stack.

SNMP 2 is also closely tied to the efforts of the Desktop Management Task Force, which has developed a reference model for network management called the Desktop Management Interface (DMI).

SNMP management applications can be written for Windows and are now capable of talking to both TCP/IP and IPX agents. NetWare servers can thus be managed remotely without the

user having to install TCP/IP. PCs with SNMP-aware network-interface cards can be managed over IPX, whereas existing TCP/IP agents in hubs and routers can continue to be managed with the same applications.

One example of network management's new course is LANdesk/OpenView for Windows, a joint venture of Hewlett-Packard Co. and Intel Corp. that will support NetWare, SNMP, and DMI. OpenView is one of the best SNMP applications for Unix available at this time, and its port to Windows will be a real boon for PC administrators.

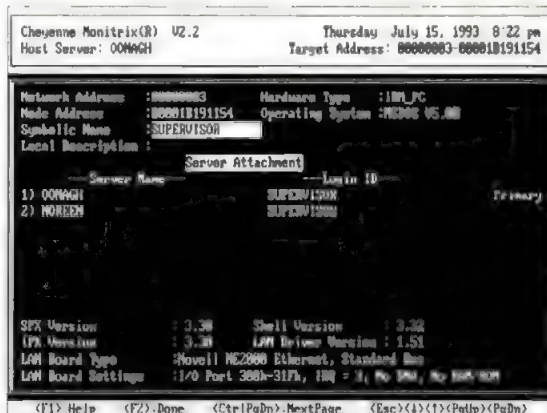
Whether your network is primarily based on DOS machines, Unix workstations, or even Macintoshes, SNMP 2 provides enough power and flexibility to live up to its name. □

offers management features, and includes a limited virus-detection option, all in one simple-to-use package that doesn't require a TSR on each client PC. There is no capability to monitor application inventory, however, or to perform software distribution. Nor does the package offer remote control. And, as with many of the other network management products in this review, reporting is lim-

ited mostly to exporting data; it's left up to the network administrator to determine the significance of that data.

Monitrix, priced at \$895 per server, supports both NetWare 2.x and 3.x. Its network inventory feature collects data from servers and bridges and stores it in a database. The network administrator can add other important information, detailing the location of the node, the user, and his or her phone extension. Client configuration details consist only of the information supplied by Novell's IPX/SPX protocol, shell program, and the system's CMOS.

Monitrix's topology and statistics option reads the network information and compiles a rudimentary map. (Network Computing's LANAlert offers a similar option with a graphical interface.) The node entries for each network can be displayed, and the shell, IPX/SPX, LAN driver, and other statistics can be viewed in real time. Data may be saved in either ASCII or .DBF formats for later analysis.



Using NetWare's familiar G-Worthy interface, Monitrix gives a manager information about each client's network connection.

Monitrix offers a peer-to-peer diagnostics tool that transfers packets between two clients on the LAN. Parameters such as packet size, number of packets, and packets per second can be input by the administrator. This is helpful in locating a problematic client system.

An important feature of Monitrix is its ability to administer the network in the background by using the loaded VAPs and NLMs. Up to 100 nodes can be monitored by Monitrix at one time, and

FACT FILE

Monitrix, Version 2.2

Cheyenne Software Inc., 3 Expressway Plaza, Roslyn Heights, NY 11577; 800-243-9462, 516-484-5110; fax, 516-484-3446

List price: \$895 per server.

Requirements: Server: 286-based PC or better; VAP: 135K RAM, 150K hard disk space; NLM: 100K RAM, 75K hard disk space; NetWare 2.1x or later. Client: 8088-based PC or better, 512K RAM, 400K hard disk space, DOS 3.3 or later.

In short: This low-priced package uses memory efficiently and includes virus protection, but it has mediocre reporting and no software monitoring.

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through the monitoring of file servers and clients, the administrator can be alerted if problems occur.

Monitrix can also put together information by collecting statistics from network nodes and their components. Administrators can designate a set period of time, a date, or a polling frequency by using their traffic statistics collector. The data is stored in Cheyenne's user-configurable Traffic Database (TDB). The data collected can be output to either an ASCII text or .DBF format.

A more sophisticated option for monitoring servers is available for 286-based clients. For these the file-server status monitor can also monitor printers, disks, caches, and the Bindery through a series of user-configurable thresholds.

Monitrix's virus detection is rather archaic. Either whole volumes or specified directories can be monitored for viruses at a user-defined interval. If a file is infected, the extension is changed to .BAD, so it is no longer usable, and the network manager is notified of the event. (Cheyenne does offer a separate product, InoccuLAN, which offers more in-depth virus-protection capabilities.)

Monitrix provides a low-cost, low-overhead network-management solution that checks client and server configurations and collects and exports very useful data into a simple-to-use package. It lacks support for software application inventory, distribution, and remote capabilities, which are offered by other more expensive products.

Frye Computer Systems Inc.

The Frye Utilities for Networks

BY PADRAIC BOYLE

When it comes to managing your Novell network, Frye Computer's network management products cover all the bases. Six separate products work individually—and jointly in an integrated way—to provide a broad spectrum of management capabilities. Each of the packages offers excellent support in its designated area, and they complement each other well. The whole suite can seem a bit pricey, but these are strong individual products—and Frye does offer its solutions over a range of network operating systems.

■ OpenView: HP Tackles the Enterprise Network

by Max Schireson

Imagine having to manage not a LAN, but a far-flung enterprise: a wide area network encompassing dozens of locations and a few thousand nodes. Chances are you would strongly consider Hewlett-Packard Co.'s OpenView.

OpenView was originally designed to give PC users a graphical console for a Unix-based Simple Network Management Protocol (SNMP) system; Version 7.0 of OpenView was released this past June.

SNMP management consoles are a far cry from the other products in this roundup. By querying agents running in hubs, routers, and network nodes, an SNMP console gathers information and issues alert messages.

Each object has its own management information base, or MIB. When OpenView queries the management agent in a device, it receives the information in that object's MIB. OpenView will then compile a database of MIBs that it recognizes. By

using different MIBs for different products, OpenView allows you to use the same tool to manage both hubs and routers. The resulting information is displayed graphically. With a powerful icon-based interface, you are able to manage the network globally or locally. You can also shift among views easily.

The package does have a few drawbacks, not the least of which is cost. OpenView for Windows will set you back \$2,500 for a full platform; the Unix version starts at \$15,000 and requires a workstation costing another \$5,000 to \$10,000. The agents aren't free either; expect to pay thousands of dollars just for the software to manage your hub. And the SNMP protocol isn't exactly perfect, though things are moving in the right direction with the introduction of SNMP, Version 2. (See the sidebar "SNMP: Living Up to Its Name?" for more information.) That, combined with OpenView's power and flexibility, makes this package a tough act to follow. □

The products are Frye Utilities for Networks (FUN)—a NetWare management tool, LAN Directory (LAND), Software Update and Distribution System (SUDS), NetWare Early Warning System (EWS), NetWare Console Commander (NCC), and Node Tracker. The products may be purchased separately and used together, allowing the network manager to choose which areas need to be covered.

The \$495 FUN is Frye's flagship product. It lets you view both the server and node information in real time. An NLM is needed on a NetWare 386 server to retrieve information; data is also available from a 286 server, though there is no need for a VAP. FUN gathers information about a file server's configuration, CPU

utilization, drivers, NLMs and VAPs, and other vital signs. Some of the screens are accompanied by helpful descriptions and setup information including client PC operating system and version, LAN adapter version and configuration, and shell version—all displayed on several intuitive screens.

Two products, LAND and SUDS, share a common database that performs LAN inventory and software distribution. The

database queries the nodes for more than 6,400 different hardware and software configurations and supports most disk and network operating systems. LAND scans clients to gather information about hardware configuration and installed software. SUDS is based on a set of crite-

SUITABILITY TO TASK

The Frye Utilities

	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	●
Server and traffic monitoring	●	●	●	●
Reporting and notification	●	●	●	●
Integration	●	●	●	○

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Composed: [Name]
Subject: [Subject]

At today's client review meeting, Mr. Champ announced that he has changed his mind and now wants to install the energy saving glass (\$750,000) in all external windows. I advised him that this would have design changes and possibly result in a slip in the schedule and an increase in overall cost. He is totally committed in making the change based on the future energy savings and is convinced that we can pull it off without delaying the project or exceeding the budget.

How can you possibly respond? Let's determine a plan of action ASAP. In some instances, we'll need design, engineering, ECO's, materials acquisition and the OK from Thierry's team in Neully. I've pulled the figures below from the Supplier's Catalog Database. Let's hope we can locate the glass and negotiate a better price with the supplier.

ITEM	QUANTITY	UNIT PRICE	TOTAL
Energy Saving Glass	144	\$5,138.89	\$740,000.16
Cost of Change			\$740,000.16

Following a client meeting, Ted, the Account Manager in NY, enters a Project Alert in the Project Tracking Database, describing some last-minute client changes. All key individuals on the project are automatically notified. He enters a spreadsheet comparing prices from the Notes Supplier Catalog database.

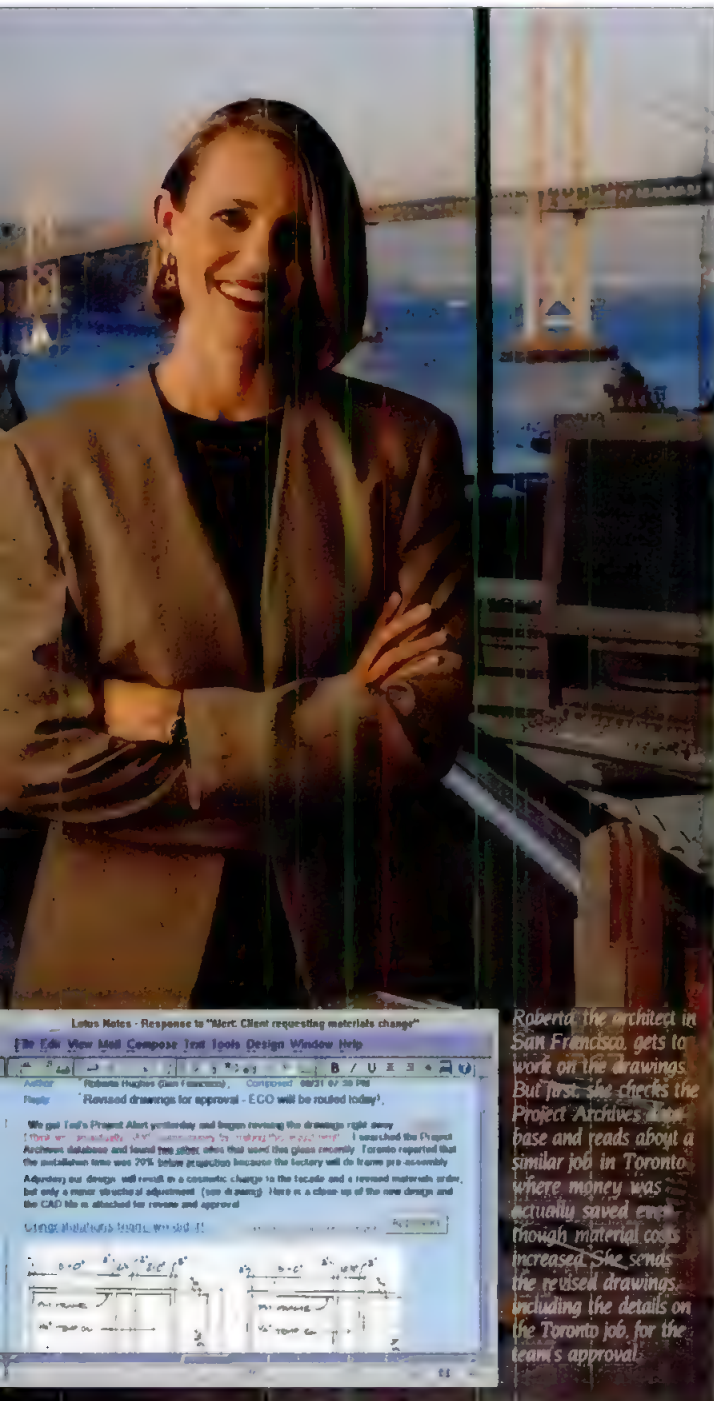
Notes

Topic: [Topic]

10/01/93 10:01 AM [Name] REQUESTING MATERIALS CHANGE. THE ORDERMAN, NEW YORK, REQUESTED... [Text continues with details of the request and responses from various team members.]

Thierry, the construction site manager in Neully, is paged via Notes, and sees the Alert (as well as responses from other team members) from his Powerbook[®] at the site. He responds that changes are possible only if the ECO and proper procedures are completed within 24 hours.

CAN WORK WITH WORK, AN ARM IN PARIS HEART IN SAN FRANCISCO.

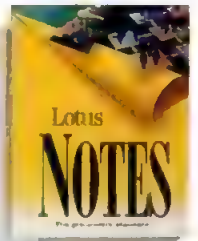


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Network Management



Frye's LAN Directory finds and displays the name, version number, and manufacturer of software installed on each network client.

ria or thresholds. Once these criteria have been met, actions can be carried out for every client or only specific machines. Both LAND and SUDS come with a complete reporting capability.

EWS is a fully customizable early warning package that monitors, notifies, and in some cases fixes servers through a set of thresholds configured by the administrator, including volume blocks used, disk I/O errors, and cache hit ratio. If a file server's volume exceeds the threshold, an alert is sent to the LAN administrator via any of nine different notification options. Working with NCC allows EWS to change settings at the NetWare console automatically when a threshold has been exceeded. For example, if memory resources are low, EWS will send out a notification that triggers

NCC to unload unneeded NLMs. Node Tracker offers diagnostics for troubleshooting the whole network.

In most cases, you can switch from one Frye product to another without exiting, and even continue to view the same node from FUN to LAND, for example. This kind of seamless integration makes the products intuitive and easy to use. NMS support is also integrated into all of the Frye products, and is used mostly for notification purposes.

Frye's six-pack attack for easing the network management worries for network administrators is comprehensive and intuitive. All of the products work individually as well as collectively to offer a real-time view and a totally automated network-management solution. The entire suite of products may initially seem expensive, but then again, so is network downtime.

Horizons Technology Inc.

LANauditor LANtrack

BY KEVIN BACHUS

Horizons Technology's LANauditor is one of the more powerful inventory packages we tested, providing support for more networks and more inventory items than many other systems.

Besides tracking hardware and configuration information on any NetBIOS network, LANauditor reports on installed software and server configurations, and can track software license restrictions. When used in combination with Horizons' LANtrack program, it can report information about your servers as well. Unfortunately, though, it doesn't handle software distribution or client remote control.

Like most other inventory managers, LANauditor comprises an auditor module that gathers client information during network log-on, and a data-

base module that collects and reports on information from the auditor.

LANauditor is well suited for enterprises with multiple network operating systems. From a single console, a network administrator can query client systems on any network in the company, whether it's running NetWare, LAN Manager, or VINES. In addition, the package can maintain inventory databases on each LAN and collect data into a centralized resource at specific times during the day.

SUITABILITY TO TASK

LANauditor and LANtrack

	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	●
Server and traffic monitoring	●	●	●	○
Reporting and notification	●	●	●	○
Integration	●	●	○	○

LANauditor can also create a "walk-around" disk that lets MIS managers collect data from non-networked PCs and feed this information into the database.

LANtrack provides the server end of the equation, offering real-time performance numbers including resource utilization and packet errors. It also allows managers to configure servers remotely.

Information about each client is collected during network log-on; LANauditor prompts for data such as the user's full name and location, and uses it to generate reports with an extra level of detail. Surprisingly, LANauditor allows you to set the frequency of data collection so that inventories are not conducted during each log-on, but rather on a preset basis, for example daily or weekly. This param-

The Frye Utilities for Networks

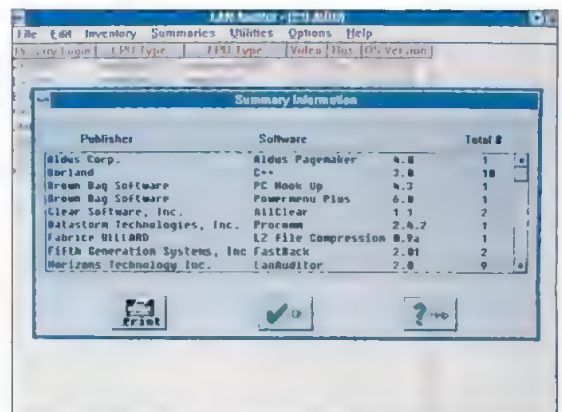
Frye Computer Systems Inc., 19 Temple Pl., Boston, MA 02111; 800-234-3793, 617-451-5400; fax, 617-451-6711

List prices (for one server): NetWare Management 1.5, \$495; NetWare Early Warning System 1.5, \$495; LAN Directory 1.5, \$495; NetWare Console Commander 1.0, \$395; SUDS 1.0, \$995

Requirements: 8088-based PC or better, 640K RAM, DOS 3.0 or later, 10MB hard disk space. All programs except LAND and SUDS require NetWare 2.x or later

In short: For the price, Frye offers lots more features and functionality than most of its competitors.

473 ON READER SERVICE CARD



Horizons' LANauditor provides software installation and version data across a wide area network.

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FACT FILE

LANauditor and LANtrack

Horizons Technology, Inc., 3990 Ruffin Rd.,
San Diego, CA 92123-1826; 800-828-3808;
619-277-7100; fax, 619-292-7321

List Price: LANauditor: 50 users, \$495; 100-user expansion, \$395; 200-user expansion, \$790; 400-user expansion, \$1,580. LANtrack: \$395 per server.

Requirements: Server: 286-based PC or better, DOS 3.0 or later, 4MB RAM, 10MB hard disk space. Client: 286-based PC or better, DOS 3.0 or later, 256KB RAM, no hard disk space. (LANtrack runs only with NetWare 2.x.)

In Short: These workhorse products are excellent for enterprise networks and multiple NOSs.

ON READER SERVICE CARD

eter can be set independently for hardware and software inventory.

LANauditor tracks a full range of hardware and configuration details that can be enhanced with administrator-supplied descriptions and serial numbers and can store copies of system files such as CONFIG.SYS, AUTOEXEC.BAT, and WIN.INI for later comparison. LANtrack was equally easy to use and provided a wealth of information about server operation, and even warned of possible future problems.

We found the audits to be extremely quick—especially when examining only hardware components. Because LANauditor attempts to determine the installed software's version number, software inventories can take up to 2 minutes per client, depending on the number of applications queried.

LANauditor's reporting tools are excellent. Queries are easily defined using a point-and-click interface, and the product ships with a number of predefined queries; users can also save their own frequently used commands. The system supports a full range of export options.

LANauditor and LANtrack provide a good combination of strong auditing, reporting, and querying tools at a fair price. Their ability to straddle multiple networks and operating systems should entice many IS managers. Although the packages don't provide such features as virus protection or remote control, they excel at their primary function.

Intel Corp.

LANDesk Manager

BY KEVIN BACHUS

Intel Corp.'s LANDesk Manager, Version 1.02, excelled in some of the areas important to a network administrator: client system inventory and reporting, remote control, and software metering. As comprehensive as any package we tested, LANDesk should be on every NetWare administrator's short list of essential management tools. The

only significant drawback to the product is its restriction to monitoring NetWare networks and DOS-based PCs; if you need to administer Macintosh or OS/2 clients, or you are using VINES, LAN Manager, or Unix, LANDesk is not for you.

The package is competitively priced—\$995 per server—and particularly attrac-

tive for sites with a small number of servers supporting a large number of clients.

As with most of the products tested, installation was simple and quick, though it did require some manual file-copying. A log of all changes made by the setup program allows managers to remove the package without having to figure out which drivers belong to LANDesk and which were added by another program.

LANDesk contains tools for client inventory and reporting, application software monitoring and distribution, remote control of clients, network packet analysis, and an anti-virus tool. (We did not test the anti-virus utility.)

LANDesk's hardware and software inventory utility is exceptional. In addition to maintaining an inventory of each client's hardware components and system configurations, Intel says it can recognize more than 1,000 different soft-

SUITABILITY TO TASK

LANDesk Manager

	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	●
Server and traffic monitoring	●	●	●	○
Reporting and notification	●	●	●	●
Integration	●	●	●	○

VisiNet: Power on the WAN

by Max Schireson

VisiSoft's VisiNet is a powerful, flexible package for creating network representations. Once you master the program's jargon, you have a powerful tool for managing your network. With support for LAN Manager, LAN Server, NetWare, and SNMP (Simple Network Management Protocol), VisiNet can handle almost any network you throw at it. It allows you to create hierarchical views of your network. At the root is your enterprise WAN. Then, the next level down can be divided into departmental LANs, or into servers, clients, and users.

VisiNet gathers data from the nodes on your network based on scripts you define. You can determine a node's network interface card, what device drivers are loaded, and even the values of environment variables. The program also allows you to define

alerts based on this information and specify how alerts move between views.

VisiSoft's NetWare module goes beyond tracking basic NetWare connectivity. On a 286-based server you can monitor everything from dirty file allocation table (FAT) sectors to total routed packets or server utilization. If you have NetWare 3.x, you can add locked records, directory searches, and file renames, among other statistics. Using VisiNet's scripts, you can easily turn the mass of raw data available on your servers into useful information.

VisiNet offers power and flexibility in managing large networks. To this end, it dynamically manages server connections, letting you work with more than eight NetWare servers concurrently. If you have the time to invest, VisiNet will pay you dividends. □

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Imagine a notebook that adjusts to the way you work instead of the other way around. The keyboard detaches when that's more convenient. You can use the pen as a pointing device, to highlight or delete text, or to take notes (you know, like a pen). And unlike "convertible" notebooks, you can comfortably use both the keyboard and pen at the same time.

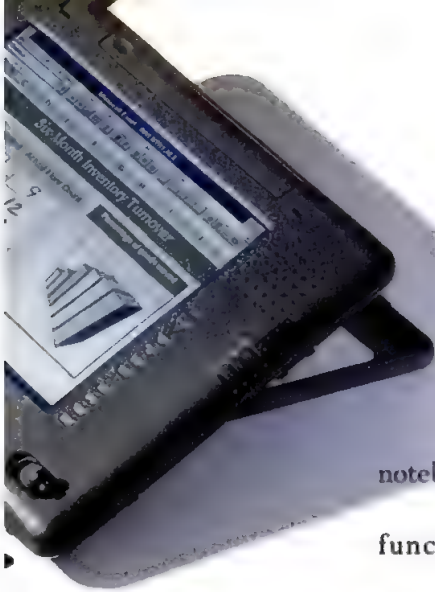


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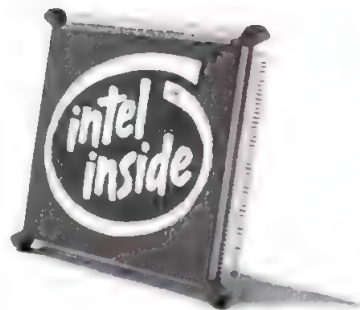


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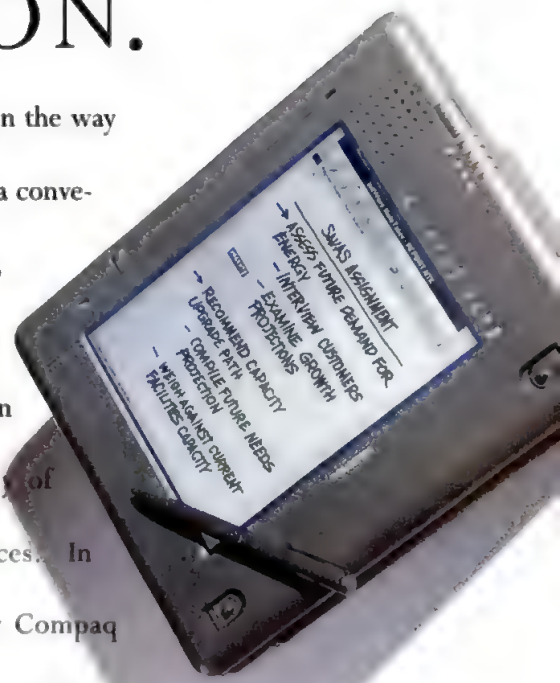
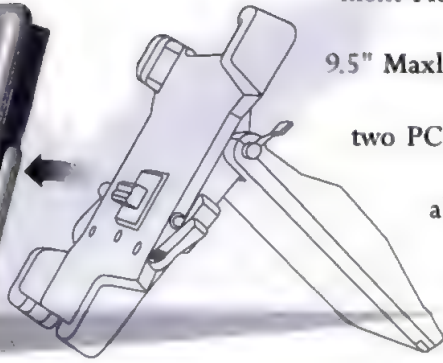
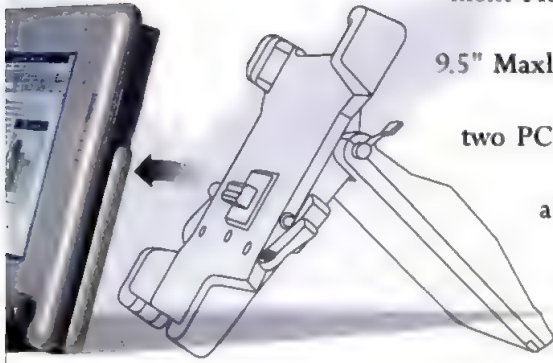
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CIRCLE 308 ON READER SERVICE CARD

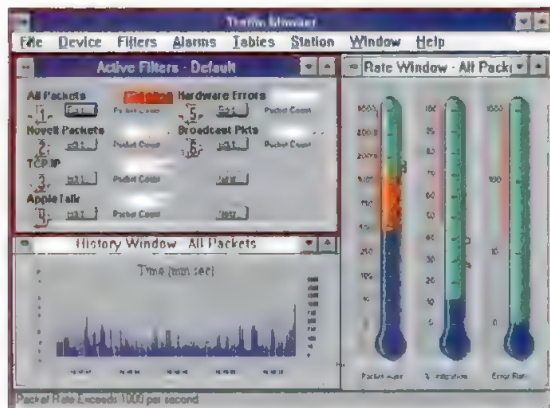
ware packages loaded onto users' hard disks. Although LANdesk occasionally misidentified DOS utilities, we could add the package titles to LANdesk's tables to avoid repeating the errors.

Hardware inventory is performed at each log-on; the administrator can check software at preset intervals. While hardware inventory can be run during each log-on without much impact to the end user, software inventory takes longer and should only be done periodically.

As with LANauditor, inventory databases can be maintained on a centralized server. For faster performance, each server can maintain individual databases that can be periodically reconciled. Also, as with LANauditor, standalone PCs and notebook computers can be added to the database using a "walk-around" disk.

Each client's entry can be customized with details such as department or serial number. In an interesting little feature, LANdesk can attach bitmapped images and sound annotations to each record. (Intel suggests using these fields to record a photograph of the primary user and the correct user-name pronunciation.)

LANdesk has one of the easiest interfaces going. By merely pointing and clicking, we built permanent and ad hoc queries that could be joined as building blocks for a larger query. Once this query is run, the result can be viewed, printed,



LANdesk Manager's Traffic Monitor uses several graphical representations to depict network activity.

or exported to a database or spreadsheet. The program also ships with DDE links to Microsoft Excel.

LANdesk's interface has one significant limitation: You can't always delete individual records from the log file.

FACT FILE

**LANdesk Manager,
Version 1.02**

Intel Corp., P.O. Box 58119, 2200 Mission
College Blvd., Santa Clara, CA 95052-8119;
800-538-3373, 503-629-7354;
fax, 503-629-7580

List price: \$995 per server.

Requirements: 386SX-based PC or better, 4MB RAM,
12MB hard disk space (for all 11 modules), NetWare
3.11, DOS 5.0 or later, Microsoft Windows 3.1.

In short: A great buy at \$995—if you have only DOS-
based clients on a NetWare network. You get inven-
tory, remote control, reporting, and software metering.

 **475** ON READER SERVICE CARD

When we attempted to keep track of all changes to each client, the log file grew to enormous proportions—with no way to trim entries short of trimming the whole file. This all-or-nothing approach will limit the number of features you'll want to monitor.

The Application Monitor was LANdesk's weakest link. Although we were able to monitor the number of users running each server-based application at any given moment, we could not restrict the number of users or control execution of locally installed programs. Also, the program requires a dedicated machine to run effectively. Application Monitor's major advantage is its ability to monitor and log access to applications and data files on the server, providing a graphical view of usage for each file.

LANdesk's Desktop Access remote-control module was adequate for most routine troubleshooting tasks. Like the remote-control features of other packages tested, it let us take over a client from any other console on the network. Desktop Access also provides basic file-transfer and remote chat capabilities.

More impressive was Traffic Monitor, which can distinguish in real time between IPX, EtherTalk, and TCP/IP packets, and report on any abnormalities that exceed a user-defined threshold.

■ **Hermes:** *What Does It Mean?*

by Kevin Bachus

Most network management packages focus on monitoring and administering servers, not client PCs. Microsoft aims to change that later this year when it introduces a package code-named Hermes.

By providing remote hardware and software inventory, automated software distribution, and remote control, Hermes promises to cut your support burden dramatically by automating most routine client maintenance. By querying the inventory database, Hermes will let you distribute software only to those client systems that need and can support the application. And as the result of a deal between Microsoft and Infonet Services Corp., you'll be able to use Hermes to monitor any part of your network—down to individual routers and hubs—from anywhere within your firm.

Although Hermes itself runs under Windows NT, it will initially support Banyan's VINES, Microsoft LAN Manager, and Novell's NetWare. And though Hermes does not directly support the Simple Network Management Protocol (SNMP) for administering networked devices, Microsoft is said to be negotiating with several large SNMP vendors to add Hermes hooks into their SNMP.

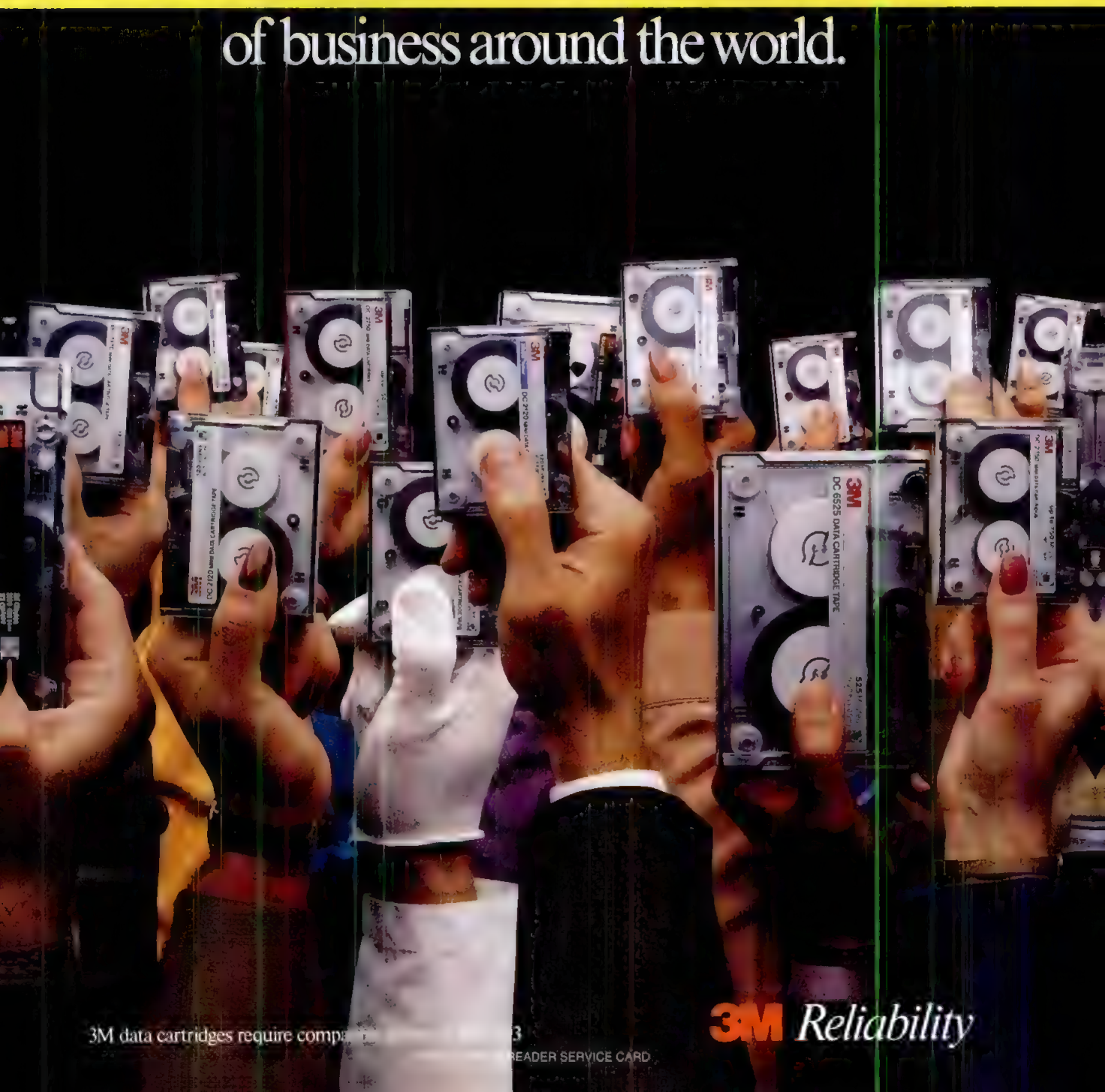
Hermes will face competition from vendors like Symantec Corp., as well as resistance from those reluctant to turn Windows NT clients over to administration duties. But Hermes's abilities both to consolidate information about a variety of different client PCs and to work across multiple transports and operating systems—as well as its simplified user interface—may yet win over its staunchest opponents. □



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3

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3M Reliability

Of particular note was Traffic Monitor's elegant interface, which let us zoom in on a particular client system and track network utilization, packet errors, and a host of other statistics.

LANdesk Manager's streamlined interface will get you up and running in no time, providing as comprehensive a set of data as any management package available. However, the system's limitation to PCs on a NetWare LAN will limit its usefulness in large, heterogeneous organizations that are looking for an all-encompassing LAN management solution.

The LAN Support Group Inc.

BindView NCS

BY KEVIN BACHUS

The LAN Support Group's BindView NCS (Network Control System) is the successor to BindView+, a server configuration and utilization monitoring tool

SUITABILITY TO TASK				
BindView NCS				
	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	●
Server and traffic monitoring	●	●	●	●
Reporting and notification	●	●	●	○
Integration	●	●	○	○

that has long been a favorite of LAN administrators. BindView 3.11 can track hardware and software inventory on both servers and client systems.

BindView is divided into the Server Information Module (SIM) and the Workstation Auditing Module (WAM), which collect information to be stored on a centralized NCS console running on the administrator's system. BindView supports clients connected to NetWare servers only and does not support Unix workstations. Support for Macintosh and OS/2 clients is expected by year-end; Windows and NT support is in development.

BindView reports client PC inventory and configuration information and provides a central station for routine server management, including accounting and trustee assignments.

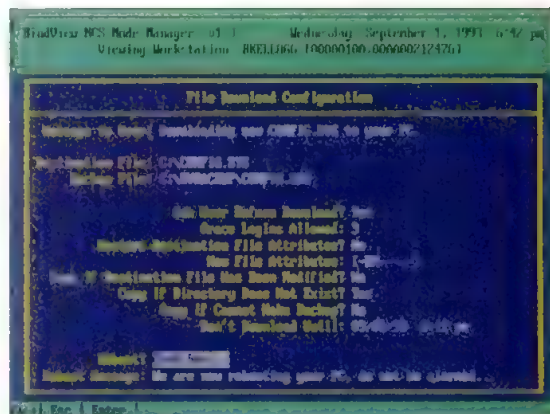
In addition to report generation and scheduling, BindView can be set to generate alerts within reports if a threshold,

such as the amount of free disk space on a particular server, is exceeded. Alerts from client PCs can be assigned priority levels and DOS commands to be executed when an alert is generated.

The range of client information collected by BindView is more than adequate. The package collects and reports on a wide range of hardware and software statistics, including CMOS values, hard-disk partition types, network-driver version numbers, and the amount and type of free memory. Clients can be audited during each log-on or at intervals preset by the administrator. In addition, auditing intervals can be set for individual clients.

Even more impressive was the system's ability to manage files on remote clients. We were able to track the primary system files—CONFIG.SYS, AUTOEXEC.BAT, and WIN.INI—and set alerts to notify us if one of them had been changed. In addition, BindView provides full-text searching of any file on a user's hard disk. Using this feature, we were able to locate an AUTOEXEC.BAT that was missing a PATH variable, capture the file, add the required command, and queue it for download the next time the user logged on.

BindView excelled in generating reports. We were able to combine client system information and Bindery data to



One of BindView NCS's strengths is its ability to track and, if necessary, replace users' system files.

provide a picture of the relationship between hardware equipment and security rights assigned to each user. Reports can be viewed, printed, or exported in a number of spreadsheet and database formats.

Because BindView stores all information in a Btrieve database, we could view past configuration details to provide a snapshot view of a client on a given date or view changes over time.

BindView NCS does not provide the sheer number of features offered by other one-stop packages, but it is an excellent tool for administrators who only need to monitor their servers and clients. The system's ability to mesh server and client information provides a much broader, all-encompassing view of the network than client-only inventory packages, and its powerful file-management tools are a much appreciated innovation.

FACT FILE

BindView NCS, Version 3.11

The LAN Support Group Inc.,
2425 Fountainview, #390, Houston, TX
77057; 800-749-8439, 713-789-0881;
fax, 713-977-9111

List price: NCS Console and one SIM, \$495, SIMs, \$395 per server; WAMs, \$395 per 100 nodes

Requirements: 286-based PC or better, 475K RAM (console), 15MB hard disk space on server, 350K hard disk space on client during audit, NetWare 2.x or later

In short: This LAN-administrator favorite provides server monitoring, client auditing, and inventory... but only for PC clients on a NetWare network

476 ON-READER SERVICE CARD

Microcom Inc.

LANlord

BY KEVIN BACHUS

Microcom's LANlord provides client PC auditing and remote control with an important twist: Rather than collecting information from the clients during log-on, the package offers real-time querying capabilities thanks to an SNMP-based TSR that can be triggered remotely. Although administrators may initially balk at the idea of giving another 19K of conventional RAM over to the agent software, we found the benefits of on-the-spot querying to be well worth the investment.

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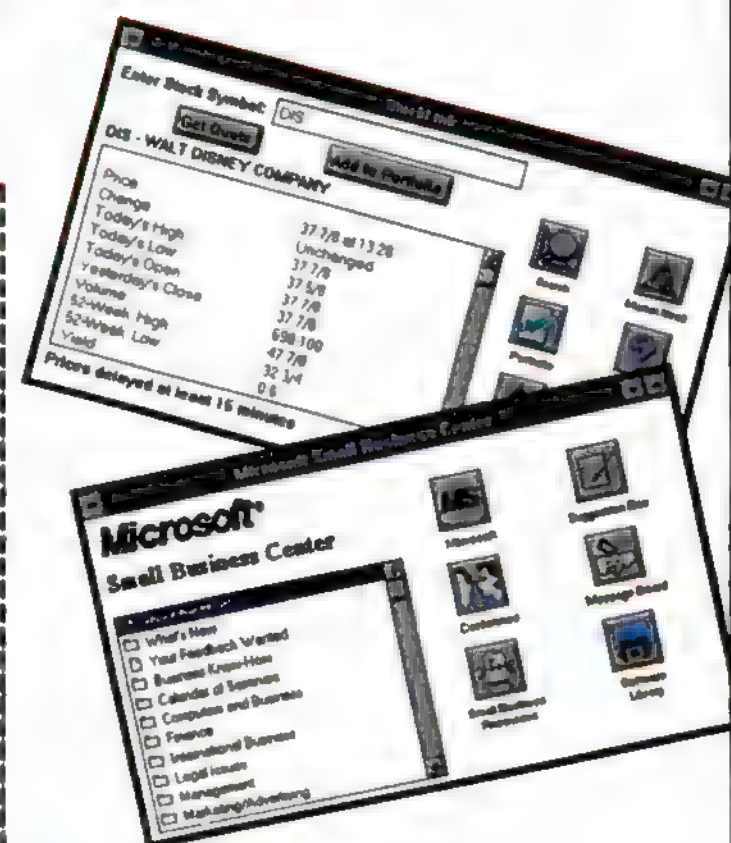


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■ Integration Upcoming

by Ryan Tabibian

If you're looking for an integrated network management product that combines the functionality of inventory management, metering, and software distribution under an easy-to-use Windows interface, the much anticipated Norton Administrator for Networks (NAFN) from Symantec Corp. could be for you.

Combining several strong functions in one simple-to-use, powerful package, NAFN (which wasn't shipping in time for this review) can be used to distribute software and files, collect detailed information about clients on the network, and track each software license in use. NAFN runs on Microsoft LAN Manager, NetWare, OS/2 LAN Server, and Windows NT.

NAFN comprises three main components. A LAN inventory feature gives you detailed information about every piece of hardware and software on the network, with a comprehensive list of installed software that includes version numbers and installation dates. A metering agent

keeps track of all software licenses in use, and a software distribution module can copy files, install software, and update drivers remotely. It even contains a built-in scripting language. Best of all, the product resides completely on the server. (If you plan to do on-line metering, however, a TSR is required on the client PC to keep track of the software license in use.)

Because NAFN is one of the only products to integrate inventory, metering, and software distribution, it's difficult to compare it with other products on the market. The Frye Utilities for Networks and Microsoft's upcoming Hermes project have similar feature sets. Frye requires you to buy several separate modules to achieve almost the same functionality (note that Frye doesn't do software metering). Sources close to Microsoft say that Hermes was not expected to ship until the fourth quarter of this year either. So, it would appear that a couple of good, integrated solutions are already on the way. □

LANlord supports NetWare, LAN Manager, and LAN Server networks. Unlike the other packages reviewed

on each client in order to provide remote client access. This can be done by adding a command to the system log-on script.

LANlord provides all the features an administrator could ask for in a client PC monitor: application license metering and auditing, client inventory, and remote control.

The package comprises three components: a DOS-based agent loaded on each client, an OS/2-based server that receives and stores information from the agents, and a Windows-based administration package. The administrator can access LANlord data from any PC on the network and even log on remotely.

We were impressed by LANlord's client inventory capabilities. Information for each client—including driver and

FACT FILE

LANlord, Version 2.0
Microcom Inc., 500 River Ridge Dr.,
Norwood, MA 02062-5028; 800-822-8224,
617-551-1000; fax, 617-551-1021

List price: 10 users, \$999, 50 users, \$2,495, 100 users, \$4,299, 250 users, \$8,999

Requirements: Server: 286-based PC or better, 4MB RAM, 20MB hard disk space, OS/2 1.3 or later. Manager: 386-based PC or better, 4MB RAM, DOS 3.3 or later. IPX/SPX 3.10 or later, IPXODI 1.2 or later

In short: LANlord has excellent client auditing and remote control on medium-to-large networks, but it requires an OS/2 client and NetWare requester

477 ON READER SERVICE CARD

DOS version numbers, a comprehensive memory map, and all CMOS data—was readily available both on-screen and in a number of standard report formats. LANlord also provides a Windows-based agent that reports information on Windows internals and system configuration files.

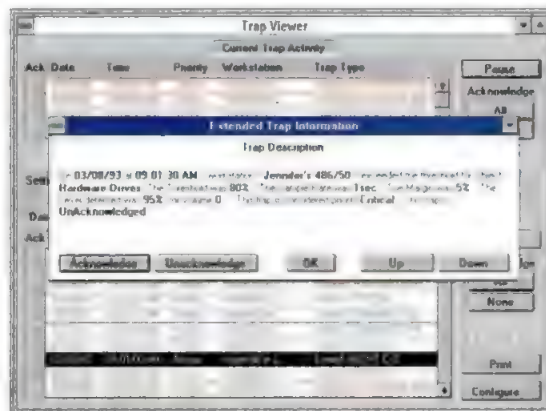
By far the package's most useful feature is its ability to notify administrators if certain client attributes exceed a preset threshold. In addition to reporting events to an error log, LANlord can generate and send an e-mail message or dial an administrator's pager.

In fact, LANlord was even able to generate an alert message when we modified a client PC's CONFIG.SYS and AUTOEXEC.BAT files. By clicking on the message, we found that we could view both old and new versions of the system files side by side. All changes were high-

SUITABILITY TO TASK				
LANlord				
	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	○
Server and traffic monitoring	●	●	●	○
Reporting and notification	●	●	●	●
Integration	●	○	○	○

here, LANlord requires the presence of a client PC running OS/2, Version 1.21 or later, to act as the LANlord server. This system must also be configured with Novell's NetWare Requester for OS/2.

Installation was smooth and ran without a hitch. System files can be loaded to a directory on the server for shared access. But the Carbon Copy for Windows "host" program must be installed



LANlord combines data entered by the LAN manager with information from the network to produce a plain-English report.

lighted, and we were given the option of restoring the old version or retaining the changes.

In addition to displaying a list of current users and a graph of past usage for each application, LANlord can be configured to block access when the maximum number of licenses has been reached. But we were unable to inventory or automatically update applications installed on a user's local hard disk. Finally, using the included version of Microcom's Carbon Copy for Windows, we could remotely take control of users' systems and correct software-installation problems.

LANlord is an excellent client-management package for medium-to-large enterprises. But keep in mind that the system requires an OS/2 client PC in order to run the server software. Although many large companies have at least one OS/2 machine somewhere on the network, those that do not will have to weigh the benefits of LANlord against the cost of such a system.

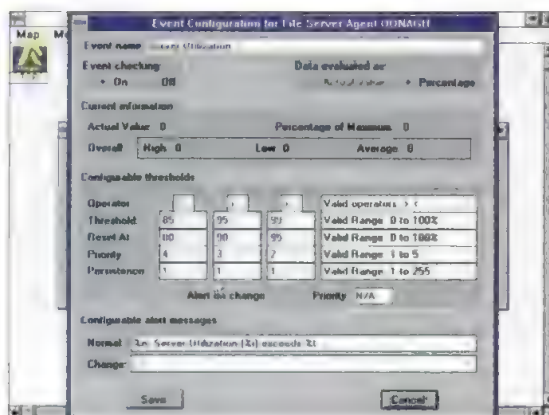
Network Computing Inc.

LANAlert LANExam

BY PADRAIC BOYLE

If you're interested in a management package that monitors the configuration of your file servers and clients, alerts you to problems, and offers advice on improving network performance, then Network Computing's LANAlert is worth checking out. Combined with a graphical interface and above-par functionality, LANAlert offers many helpful network management features. But there is no way to dynamically view a server's statistics, minimal software inventory, and no software distribution. And there are no remote control capabilities.

A Windows-based product, LANAlert derives much of its power from a runtime version of HP OpenView. It does not, however, utilize all of OpenView's features.



LANAlert's Windows interface makes it easy to configure a variety of event thresholds for notification and action.

Before you monitor the network, the monitoring station requires loading of a 32K TSR along with Windows 3.1. For the security conscious, a separate log-on and password are needed to access LANAlert. No other TSRs are needed for any other stations. At the server end, an NLM or a VAP is required to gather all data needed for the LANAlert monitoring station.

Server resources such as memory usage, disk I/O, and FAT errors are monitored through a series of user-configurable thresholds with five different severity levels, one being the lowest, five the highest. These offer different responses to various network events, from sending e-mail to paging the administrator. But you can choose to only monitor thresholds, and not view the file-server statistics.

Each time a user logs on to the network, a program is executed from the system log-on script that quickly inventories the client system's configuration and log-on name and then stores the information in a database that can be viewed or exported to an ASCII text file for later analysis. If a system's configuration has changed since the last log-on—a floppy disk drive may be out—an alert is sent to the network monitor and stored in a log file. This can be handy; you may not want to be contacted for an off-line printer, but you may want the event documented in a log.

Severity levels are configured the same as the server's. A module (\$295) to allow the administrator to be contacted by pager is also available.

Using HP OpenView's mapping ability, a network map is produced showing each node on all networks, including servers, bridges, and clients. A few drawbacks are an eight-character limit on labeling a node and a steeper learning curve for managers new to OpenView's mapping program. Still, this is a very useful feature to help break a network

into separate layers for easier management. The only other product tested capable of a similar function is Monitrix.

LANAlert offers an event-sensitive on-line help for problem diagnosis. Advice is also offered on feasible configuration changes that can improve performance on the LAN. In our testing, for example, a lot of data was moving across the network between a client on one LAN and a server on another. LANAlert suggested moving the client into the same network to improve performance.

Network Computing's LANAlert's strong points lie in network configuration, alert capabilities, and an ability to offer advice. But if you're in the market for a network product that also features software metering, software distribution, or remote control of a client, you might want to look elsewhere.

FACT FILE

LANAlert and LANExam

*Network Computing Inc., 3031 Tisch Way,
#910, San Jose, CA 95128; 800-736-3012,
408-296-8080; fax, 408-296-8329*

List price: LANAlert: first server, \$995; additional file servers, \$795 each. LANExam: \$595 per 100 nodes.

Requirements: Server: 386-based PC or better, 8MB RAM, 20MB hard disk space, NetWare 3.11. Client: 386-based PC running Microsoft Windows 3.11 enhanced mode, 4MB RAM, 10MB hard disk space

In short: These apps monitor servers and clients, alert you to problems, and suggest solutions. But you don't get dynamic viewing of statistics or remote control



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Saber Software Corp.

Saber LAN Workstation

BY KEVIN BACHUS

The network manager's equivalent of a Swiss Army knife, Saber LAN Workstation, Version 1.0D, provides inventory and license management features, as well as utilities to build custom menus, manage print queues, and run predefined network batch jobs at selected times.

For this review, we concentrated exclusively on the application handler and inventory modules of Saber LAN Workstation and found that the product is more than up to the task of managing clients across an enterprise network.

Installing Saber LAN Workstation properly, on the other hand, can take the better part of an afternoon. Although the program's installation routine copies system files to the server and initializes the inventory database, much of the configuration still must be done by hand. Fortunately, the inventory and application handler modules install almost automatically. A batch file that loads the inventory collection agent is added to the system's log-on script, and the network administrator can easily add applications and license limits

to the application database. The agent batch file can be modified to meet the needs of the particular workgroup or user.

Saber LAN Workstation's inventory utility collects data on client hardware and logs any changes it discovers in a user's setup. As with Horizons Technology's LANauditor, network administrators can add information to the log such as vendor names, descriptions of the user or equipment, and serial numbers.

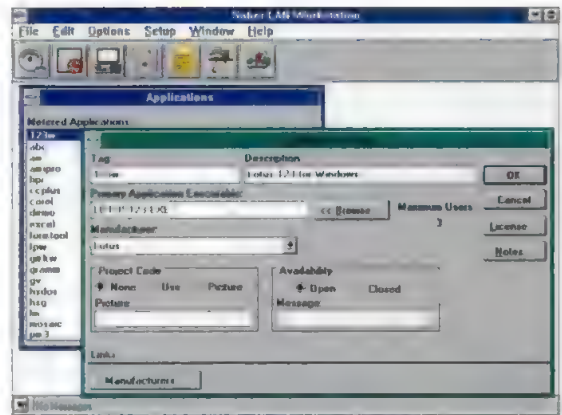
The application handler module, which is Saber LAN Workstation's license metering tool, is able to limit the number of times an application can be loaded concurrently and can provide statistics about each application, including frequency of use and peak usage times. It can even report on the need for additional software

based on frequent access denials. Moreover, the application handler module can check for the presence of viruses, adding an additional level of comfort for an overworked IS staff.

Although not as sophisticated as other inventory products, Saber LAN Workstation records the most important details about each PC, including CPU type, memory available, drive statistics, and video resolutions. Client systems are recorded both by machine ID and by user name even if a user logs on from another station, ensuring proper data collection. Saber LAN Workstation also records applications installed on local and network drives based on an administrator-defined update schedule.

During testing, we found that we could easily browse the database, build queries, and generate spreadsheet-style reports from within Saber LAN Workstation's central console. These reports could be exported as ASCII, dBase, or Paradox data files.

We were much more impressed by the application handler module. It success-



License and other information about network software is provided by Saber LAN Workstation's application handler.

fully locked out attempts to run applications beyond the license limit. Its reports were helpful and clear, and its ability to detect viruses was an added bonus.

Saber LAN Workstation provides much more than inventory and license management. Be prepared to pay for that functionality, however. In addition to the base package's \$195 price, you'll have to pay \$79 per node, a sum that can represent a considerable investment in a large organization. In small-to-medium companies or individual departments, however, Saber LAN Workstation could quickly become the network manager's best friend.

Shany Inc.

AlertView, Version 2.1

BY PADRAIC BOYLE

Most network management products spend considerable effort monitoring and controlling the network file server, with little emphasis on monitoring the client

SUITABILITY TO TASK				
AlertView				
	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	●
Server and traffic monitoring	●	○	○	○
Reporting and notification	●	●	●	○
Integration	●	○	○	○

systems making up the LAN. Shany's AlertView, Version 2.1, though, changes the way such clients are viewed and maintained. By offering the ability to monitor

FACT FILE

Saber LAN Workstation, Version 1.0D

Saber Software Corp., 5944 Luther Ln., #1007, Dallas, TX 75225; 800-338-8754, 214-361-8086; fax, 214-361-1882

List price: \$195 per computer (server or client), \$79 for additional node licenses (does not include documentation or media)

Requirements: 286-based PC or better, 1MB RAM, 10MB hard disk space, DOS 3.1 or later, Windows 3.x

In short: The Swiss Army knife of network management, this package includes everything. But for a larger LAN, you'll pay a lot thanks to the pricing structure

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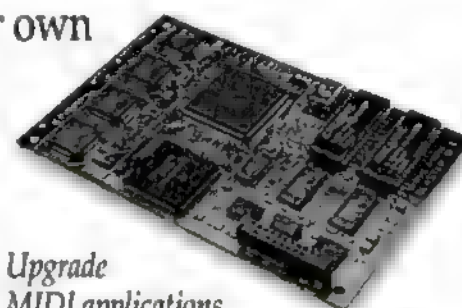
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	Sound Blaster 16 Basic Edition	Sound Blaster 16 MultiCD	Sound Blaster 16 SCSI-2
Format	16-bit stereo	16-bit stereo	16-bit stereo
Advanced Signal Processing Upgradability	Yes	Yes	Yes
Wave Blaster Upgradability	Yes	Yes	Yes
CD-ROM Compatibility	Creative Labs/Panasonic	Sony, Mitsumi, Creative Labs/Panasonic	Any SCSI or SCSI-2
Bundled Hardware		Microphone	Microphone
Bundled Software	Monologue for Windows Creative WaveStudio Creative Soundo'LE Creative Talking Scheduler Creative Mosaic	Software Toolworks Multimedia Encyclopedia HSC InterActive SE PC Animate Plus Monologue for Windows Creative WaveStudio Creative Soundo'LE Creative Talking Scheduler Creative Mosaic Creative VoiceAssist	Software Toolworks Multimedia Encyclopedia HSC InterActive SE PC Animate Plus Monologue for Windows Creative WaveStudio Creative Soundo'LE Creative Talking Scheduler Creative Mosaic Creative VoiceAssist
Suggested Retail	\$199.95	\$249.95	\$279.95
W/Advanced Signal Processing	Not applicable	\$299.95	\$329.95



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CREATIVE
CREATIVE LABS, INC.

► SUMMARY OF FEATURES

Network Management Software



Products listed in alphabetical order by company name

■ = YES □ = No

	Brightwork Development Corp Brightwork Utilities for NetWare	Cheyenne Software Inc. Monitrix	Frye Computer Systems Inc. The Frye Utilities for Networks	Horizons Technology Inc. LANauditor, LANtrack	Intel Corp. LANDesk Manager
Client types supported	DOS, Macintosh, Microsoft Windows	DOS	DOS, Windows, OS/2	DOS, Microsoft Windows	DOS, Microsoft Windows
Network operating systems supported	NetWare	NetWare	NetWare (LAND and SUDS also work on VINES, LAN Man- ager, LAN Server, Pathworks, StarLAN)	NetWare, LAN Manager, LAN Server, NetBIOS- based networks, Pathworks, VINES	NetWare
User notification options	E-mail, on-screen, pager	E-mail, on-screen, pager	Audio, e-mail, fax, on-screen, pager	On-screen	E-mail, on-screen
Integration					
Common database/Common interface	□ ■	■ ■	■ ■	□ □	■ ■
Supports SNMP	□	□	□	□	■
Reports					
User-definable fields or screens	■	■	■	■	■
Can query on each item	■	■	■	■	■
Data export formats	CSV, DBF, TXT, .WK1, .XLS	ASCII, DBF	ASCII, CSV, DBF, TXT	ASCII, DBF, DIF	ASCII, CSV
Inventory-management module	LAI	Monitrix	LAN Directory	LANauditor	LANDesk Manager
Type of hardware inventoried	DOS, Macintosh	DOS	DOS, Macintosh	DOS	DOS
Number of client items identified	40	20	250	100	150
Tracks changes/Notifies users of changes	■ ■	■ ■	■ ■*	■ ■	■ ■
Type of software inventoried	DOS, Macintosh, Microsoft Windows	N/A	DOS, Macintosh, Microsoft Windows, OS/2	DOS, Microsoft Windows	DOS, Microsoft Windows
Number of software titles inventoried	2 000	N/A	5 700	1,100	1 500
Tracks changes/Identifies version	■ ■	N/A	■ ■	■ ■	■ ■
Traffic-monitoring module	NETremote+	Monitrix	Node Tracker	N/A	LANDesk Manager
Number of items monitored	15	50	90	N/A	8
Nature of items monitored	Packets sent/ received, errors	Disk s Bindery, file server, network traffic	IPX statistics, SPX, shell and shell drivers	N/A	Destination, errors, packet type, quantity, source
Has user-definable thresholds	□	■	□	N/A	■
Tracks error rates/Identifies errors	■ ■	■ ■	■ ■	N/A	■ ■
Client-monitoring module	NETremote+/LAI	Monitrix	Node Tracker	N/A	LANDesk Manager
Number of items monitored	15	50	90	N/A	45
Nature of items monitored	Screen, keyboard, mouse	Client traffic	IPX statistics, SPC, shell and shell drivers	N/A	CMOS, device drivers, interrupt vector, memory map, ROM, extension
Remote control of keyboard activity	■	□	□	N/A	■
Server monitoring and reporting module	NETremote+/LAI	Monitrix	NEWS, FUN	LANtrack	N/A
CPU/memory utilization	□ □	□ □	■ ■	■ ■	N/A
Disk/volume utilization	■ ■	□ ■	■ ■	■ ■	N/A
Applications software distribution module	N/A	N/A	SUDS	N/A	LANDesk Manager
Automatic install or update	N/A	N/A	■	N/A	■
User-definable rules for events	N/A	N/A	■	N/A	■
.INI file management	N/A	N/A	■	N/A	□
Job completion status reported	N/A	N/A	■	N/A	□

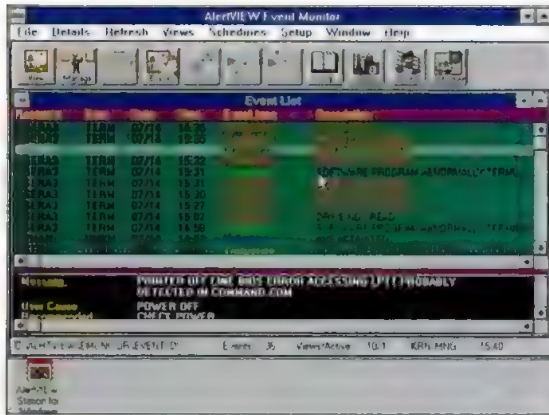
N/A—Not applicable. The product does not have this feature *Notifies of changes via reports only **Inventories running programs only

NETWORKING

Network Management

ENDS

LAN Support Group Inc. BindView NCS	Microcom Inc. LANlord	Network Computing Inc. LANAlert, LANExam	Saber Software Corp. Saber LAN Workstation	Shany Inc. AlertView	Touchstone Software Corp. CheckIt LAN	Triticom Argus/n	XTree Co. XTree Tools for Networks
DOS, Microsoft Windows	DOS, Microsoft Windows	DOS, Microsoft Windows, OS/2, Unix	DOS, Microsoft Windows	DOS, OS/2, Microsoft Windows	DOS, OS/2	DOS, Microsoft Windows	DOS, Microsoft Windows
NetWare	NetWare, LAN Manager, LAN Server	NetWare	NetWare LAN Manager, LAN Server, LANtastic, VINES, Microsoft Windows for Workgroups	NetWare 3.11, 4.0, LAN Manager, LAN Server (Others using IPX, NetBIOS, DLC)	NetWare	Argus/n (NetWare only; Vision series is NOS independent)	NetWare
On screen, pager (third-party)	Audio, e-mail, on-screen, pager	Audio, on screen, pager	On-screen	E-mail	Printer	On-screen	E-mail, on-screen, pager
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
□	Optional	■	■	■	□	□	□
■	■	■	□	■	□	□	■
■	□	■	■	■	■	■	□
ASCII (fixed and delimited), DBF, WK1	DBF, CSV, PDX	BTW, CSV	ASCII, DBF, PDX	ASCII, DBF, CSV, TXT	.DBF	ASCII	CSV
WAM	LANlord	LANExam	Saber LAN Workstation	AlertView	CheckIt LAN	Argus/n, Argus/n Internetwork	N/A
DOS	DOS	DOS	DOS	DOS	DOS	DOS	N/A
471	175	67	19	40	11	34	N/A
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	N/A
DOS, Microsoft Windows	DOS	DOS, IPX drivers, NetWare	DOS, Microsoft Windows	DOS, Microsoft Windows, OS/2	DOS, OS/2	IPX/SPX NetWare Drivers	N/A
5,343	N/A	6	955	Varies**	3,500	3	N/A
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	N/A
N/A	LANlord	LANExam	N/A	N/A	N/A	EtherVision, Token Vision, ArcVision	N/A
N/A	60	58	N/A	N/A	N/A	70	N/A
□	Bad packets, packets out/in, resource utilization, retries	NetWare Driver, SPX/IPX information, Shell information	N/A	N/A	N/A	Network utilization, errors, network activity	N/A
N/A	■	■	N/A	N/A	N/A	■	N/A
N/A	■ ■	■ ■	N/A	N/A	N/A	■ ■	N/A
N/A	LANlord	LANExam	Saber LAN Workstation	AlertView	CheckIt LAN	Argus/n, Argus/n Internetwork	WorkStation Monitor
N/A	20	67	19	67	2	20	65
N/A	Disk space, configuration changes, log-on/log-off, program executions	System hardware, SPX/IPX information, network traffic alerting	Ports, mouse, video, hard disk storage, base memory	OS errors, application start, stop, and errors; print or file problems	IPX/SPX statistics	Currently executing, recently executed, memory map, reboot, view screen	IPX/SPX stats, shell diagnostics, configuration, system, memory map
N/A	■	■	□	■	□	■	■
SIM	N/A	LANAlert	Saber LAN Workstation	N/A	CheckIt LAN	N/A	ServerMonitor
□ ■	N/A	■ ■	□ □	□ ■	■ □	□ ■	■ ■
■ ■	N/A	■ ■	■ ■	□ ■	■ ■	□ ■	■ ■
WAM	LANlord	N/A	Saber LAN Workstation	AlertView	N/A	N/A	N/A
■	■	N/A	□	□	N/A	N/A	N/A
□	□	N/A	■	■	N/A	N/A	N/A
■	■	N/A	■	■	N/A	N/A	N/A
■	■	N/A	■	■	N/A	N/A	N/A



Shany's AlertView prepares a log file of network events, using color-coding to denote severity.

events occurring on a client and linking those events with actions, AlertView can manage automatically a variety of client system functions and, in some cases, address problems as they happen. But it offers no server-monitoring abilities, and reporting is limited to exporting data. The administrator must interpret the output. (Due out by the time you read this, Version 2.2 will include TCP/IP support.)

Available for DOS, Windows, and OS/2, AlertView covers a broad array of client characteristics, and the Windows-based graphical interface makes it easy to navigate. Three programs make up AlertView. The first, AlertView Station (AVS), runs as a 33K TSR on the clients you wish to manage. If upper memory is available on the machine, AVS will load most of itself there, conserving your precious conventional memory.

FACT FILE

AlertView, Version 2.1

Shany Inc., 1101 San Antonio Rd.,
Mountain View, CA 94043, 415-694-7410;
fax, 415-694-4728

List price: 10 users, \$935; 20 users, \$1,775; 50 users, \$4,150

Requirements: Manager Station: 386-based PC or better, 4MB RAM, 3MB hard disk space, DOS 3.3 or better, Microsoft Windows 3.1. Client: DOS 3.3 or later, Windows 3.x or OS/2 1.3 or later.

In short: AlertView has an outstanding ability to acknowledge and act on client errors, yet its reporting capability needs work.



ON READER SERVICE CARD

The nucleus of AlertView, AVS acts like an SNMP agent, collecting all data at the client level and sending it back to the AlertView manager. AlertView works with NMS by sending and receiving error traps from NMS; it even filters error events. AVS allows remote view and control of client configurations.

The second program, AlertView Manager (AVM), allows the LAN administrator to view clients from one management console. Clients are inventoried and data exported as

ASCII text or in CSV format, but no reporting program is built into AlertView. AlertView filters, event triggers, and views are customizable. Much like XTree Tools for Networks, clients are remotely controlled from the management console. AVM can also freeze, reboot, and send messages to client systems. Remote mouse control is supported if a mouse driver is loaded at the management client. You can dynamically view the available memory and active applications on a client, and you can stop and start any DOS, Windows, or OS/2 application, as well as unload most drivers. One key element of AlertView is its ability to solve client problems without direct intervention by client-service personnel. AlertView Event Monitor examines the events sent by AVS agents and determines the appropriate response.

Filters are designed to remove events not considered an error condition. If an application such as WordPerfect is looking for more file handles, an event code is sent and a trigger automatically modifies the client's CONFIG.SYS with more file handles. The CONFIG.SYS may also be reexecuted without the user manually rebooting the client. No other product tested supports such a technology. (The only product that comes close is Frye's SUDS, but it can only update a client's CONFIG.SYS at log-in time.)

AlertView's extensive monitoring of DOS, Windows, and OS/2 clients makes a viable product for LAN administrators and client service groups. But Shany should make AlertView a complete network management solution and add some management abilities for network servers and better reporting all around.

TouchStone Software Corp.

CheckIt LAN, Version 2.11

BY MAX SCHIRESON

CheckIt LAN, Version 2.11, offers hardware and software inventory and diagnostics across a network similar to TouchStone Software Corp.'s PC testing package, CheckIt PRO: SysInfo. Along with automatic scheduling of off-hour op-

erations, CheckIt LAN also offers a database to store and compare the results.

Starting CheckIt LAN was simple. We just put in the floppy disk and typed Install, and

we were off. After confirming the server name with the operator, the install program needs only a single disk swap to complete it. The client TSR is located on the server, so nothing need be installed on local hard disks.

CheckIt LAN offers the comprehensive PC diagnostics of CheckIt PRO,

SUITABILITY TO TASK

CheckIt LAN

	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	●
Server and traffic monitoring	●	●	○	○
Reporting and notification	●	●	○	○
Integration	●	○	○	○

FACT FILE

CheckIt LAN, Version 2.11

TouchStone Software Corp., 2130 Main St.,
#250, Huntington Beach, CA 92645; 800-
531-0450, 714-969-7746; fax, 714-960-1886

List price: 5 users, \$149.95; 20 users, \$249.95; 50 users, \$499.95; 100 users, \$699.95; 250 users, \$999.95

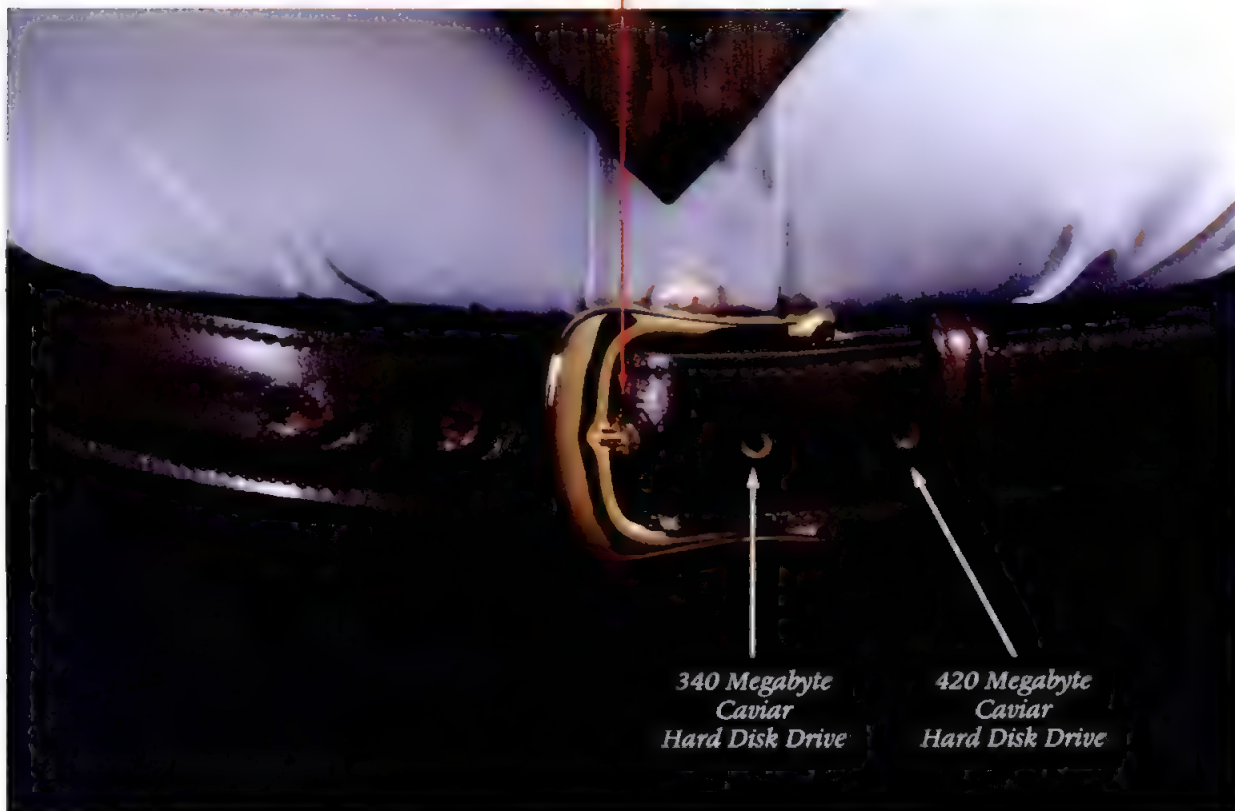
Requirements: Server: 8088-based PC or better, NetWare 2.15 or later, 250K RAM (VAP or NLM), 10MB hard disk space. Client: 8088-based PC or better, DOS 3.0 or later, OS/2 2.x, 425K RAM (512K recommended).

In short: Designed for diagnostics, CheckIt LAN excels at reactive management but has weak inventory features and no software distribution capabilities.



ON READER SERVICE CARD

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Hard Disk Drive

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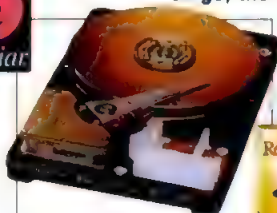
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Network Management



CheckIt LAN allows individual workstation auditing to be either scheduled or performed manually.

including processor, memory, disk, and video tests. CheckIt LAN's strength lies in its tests—it goes one step past inventory. After finding out what is in your machine, the software enables you to check for proper function component by component. In addition to verifying proper operation, CheckIt performs basic performance tests and provides comparisons with the old PC/XT level of performance.

CheckIt also checks IPX and SPX statistics for malformed packets, ECB requests and failures, number of sockets configured, maximum connections, and almost anything else you want to know. CheckIt also identified the model of the network interface cards we were using as well as the interrupt settings.

CheckIt includes basic server monitoring. It looks at disk space, directory entries, CPU utilization, open files, and connections in use. It won't monitor for more in-depth information such as bad blocks or the number of service processes on the server. Thresholds are set and alerts sent if they are exceeded. If you run NetWare 2.x and the NetWare for Macintosh VAP, you may have problems with the serial communications and be unable to receive the alerts remotely.

On the software side, CheckIt does virus checks as well as driver and software inventories of the clients, claiming to recognize more than 3,200 packages. But CheckIt won't perform automated updates or any sort of software distribution.

We found CheckIt to be wanting in some aspects of inventory management. Although the administrator can print reports of new or changed items, there is

no report of "missing" items. Also, while the package gives an impression of actually testing RAM and physically verifying the presence of whatever amount it reports, it only checks the CMOS for configuration information. To be an effective asset management tool, CheckIt needs to provide data as robust as possible—checking the machine, not the CMOS—and process the data so that the administrator can view a list of important changes, including deletions.

Tests and inventories are relatively time-consuming but can be scheduled at night. To execute an inventory on a network with Windows clients, though, you need to arrange that everyone exit Windows, run Watch, and leave the computers on. Searches of the database are relatively fast; in addition, CheckIt indicates which machines meet the search criteria before a report is run.

CheckIt offers effective diagnostics running on DOS PCs over a network and some server-monitoring abilities, offset by a none-too-good inventory control aid and no software distribution abilities. As a reactive troubleshooter, CheckIt improves productivity for PC support personnel in a big office. But if you want a comprehensive proactive tool for proactive network management, you probably need another package.

Triticom
Argus/n

BY KEVIN BACHUS

Triticom's Argus/n is a two-sided coin. One face shows a well-implemented, inexpensive product for handling most routine hardware inventory tasks, especially across a number of network segments. Its other side, however, shows the package's weaknesses; we were restricted by its bare-bones features and limited reporting capabilities. But keep in mind that it remains one of the most affordable packages we tested.

Argus/n's installation routine was among the easiest we went through. The software consists of two pieces: Argus,

FACT FILE

Argus/n, Version 1.50

Triticom, P.O. Box 444180

Eden Prairie, MN 55344; 612-937-0772;

fax, 612-937-1998

List Price: 1 NetWare segment, \$245; 5 NetWare segments, \$645; 5-segment add-ons, \$495 each.

Requirements: 8088-based PC or better, 500K RAM (4-6K per node for ArgusEye TSR), 416K hard disk space, DOS 3.1 or later, IPX 2.1 or later

In Short: A weak reporting engine and limited functionality hamper an otherwise well-designed, inexpensive product that handles most routine hardware inventory tasks with ease.



ON READER SERVICE CARD

the management software, and ArgusEye, the client agent. Installation involved copying the two applications onto a file server before adding ArgusEye to the system's log-on script. By copying ArgusEye into the SYS:LOGIN directory, we were able to ensure that every client PC on the network could access the program.

Argus automatically generates and initializes all necessary databases without user intervention and can automatically

SUITABILITY TO TASK

Argus/n

	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	○
Server and traffic monitoring	●	●	○	○
Reporting and notification	●	●	●	○
Integration	●	○	○	○

add users and clients as they run ArgusEye.

Argus/n provides a simple hardware-inventory system that allows browsing, querying, and report generation. The system also reports a number of network statistics, though not as many as several of its competitors offer. Reports can be saved as ASCII files and imported into a database or spreadsheet. In addition, we found that we could take over each client PC's screen and keyboard across the network using the package's (rudimentary) remote-control facility.

Argus/n reports on nearly all of the basic hardware components installed in

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Network Management



The Argus/n Detail Menu lets an administrator choose from a list of functions for managing and troubleshooting a station.

a client PC, including details about the CPU, video card, and hard and floppy disk drives. In addition, it keeps track of DOS and network driver information and memory contents. But Argus/n takes much of its information from data stored in the system's CMOS and thus does not provide details on important aspects of system operation, such as the amount of free hard disk space on each PC and the number of network packet errors (though Argus/n can report several other network performance statistics).

As with most of the other packages in this roundup, once we had collected information from the clients, we were able to browse through the database and

*Argus/n should
please network
administrators
who only want to
keep track of
the basics.*

compare modified client configurations with previous setups.

Argus/n shows its shortcomings on the software side, with its limited inventory ability. Though the system can report both the application that is currently executing on each networked PC as well as the amount of time since the application has been active, there is no way to

determine which pieces of software—not to mention their version numbers—are loaded on the PC's hard disk. Though an administrator could use this facility to keep tabs on the number of PCs running a given application, there is no way to set limits on the number of concurrent licenses for each.

Finally, though Argus/n lets a system administrator take over control of remote PCs' screens and keyboards, we were unable to do so when running applications in nonstandard graphics modes, such as

800-by-600 Super VGA resolution.

Argus/n should please network administrators who want only to keep track of the basics. Its low cost and decidedly robust internetwork support, combined with its decent report generator, make it a good choice as an entry-level management tool.

XTree Co.

XTree Tools for Networks

BY PADRAIC BOYLE

XTree Co., perhaps best known for XTree Gold, its easy-to-use file management product, has now entered the network management arena with XTree Tools for Networks (XTN).

XTN comprises seven modules: Backup and Restore, Configuration Manager, NetTrack, QuickStat, Server Monitor, WatchLAN, and Workstation Monitor. XTree has also incorporated Performance Technology's POWERSave for a full network backup solution. (Version 1.5 should be shipping by the time you read this.)

An NLM is needed to allow the monitoring of a NetWare 3.x server; 2.x servers do not require any value-added processes (VAPs). Clients require a 7K TSR. Both servers and clients are monitored dynamically at an interval set by the network administrator. The modules gather information needed and can display data

both graphically and numerically. A built-in report capability in most modules lets you print information or save it to a file in an ASCII text format.

The Configuration Manager module makes changes to your network and documents the original configuration and all changes made. Besides allowing basic user management, XTN also displays all users who have supervisor-equivalence status on a server.

SUITABILITY TO TASK				
XTree Tools				
	POOR	FAIR	GOOD	EXCELLENT
Client PC and inventory management	●	●	●	○
Server and traffic monitoring	●	●	●	●
Reporting and notification	●	●	●	○
Integration	●	●	●	○

XTN can view a client's operating system, IPX/SPX and shell versions, and other pertinent network information through the Workstation Monitor module. Statistics such as IPX/SPX and shell data can be viewed in real time, and the AUTO-EXEC.BAT and CONFIG.SYS can be edited. XTN also lets you control client PCs remotely through a TSR on the client. But there is no reporting capability built in.

The Server Monitor module offers the same capabilities as NetWare 2.x's Fconsole utility, but with reporting capabilities added. In a 3.x environment, XTN gathers information from the NLM. Performance statistics can be viewed in real time. You can access the 3.x server console from the management client, provided that the Rconsole NLM is loaded.

QuickStat and WatchLAN perform

NetTrack v1.02						Loggings: MOREEN					
	Curp	Avg	Peak	Mean	Max	Connections	Curp	Avg	Peak	Mean	Max
Utilization	12%	3%	13%	x	x	Open Files	5	4	5		
Cache Ratio	84%	84%	84%	x	x	Dirty Cache	0	0	2		
Allocation	2x	2x	2x	x	x	I/O Pending	0	0	1		
SwapProc/FSP	9	9	9			Free Buffers	0	0	1		
Total Cache	3876	3876	3876			Response Time	0	0	0		
Dir Buffers	21	21	21								
	Current		Average		Maximum		Cumulative				
File Open Requests	14		3,707		14		3,707				14
File Read Requests	9		9		9		9				9
File Write Requests	464		464		464		464				464
File Kbytes Read	1		1		1		1				1
File Kbytes Written	1		1		1		1				1
Total Packets	90,694		90,694		90,694		90,694				90,694
Routed Packets	217		217		217		217				217
Packets Received	45,336		45,336		45,336		45,336				45,336
Packets Sent	45,358		45,358		45,358		45,358				45,358
Kbytes Received	2,684		2,684		2,684		2,684				2,684
Kbytes Sent	2,697		2,697		2,697		2,697				2,697
Start: 8/7/93 @ 82:56pm Cycle: 1 (82:56pm - 83:56pm) Time: 83:02:00											

XTree's NetTrack monitors server utilization, file I/O, and packet information across the network.

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FACT FILE

**XTree Tools for Networks,
Version 1.02**

*XTree Co., 4115 Broad St., Bldg. 1, San Luis
Obispo, CA 93401-7993; 800-876-6368,
805-541-0604; fax, 805-541-4762*

List Price: \$695 per server (additional servers, \$395)

Requirements: 8088-based PC or better, 640K RAM,
2.5MB hard disk space, NetWare 2.15 or later, DOS
3.x or later.

In Short: XTree Tools for Networks has server and
client monitoring, statistics, and reporting rolled into
one easy-to-use package. It only falls short in its soft-
ware distribution and management.



ON READER SERVICE CARD

similar duties and share the same tests and data formats. QuickStat looks into the health of the server. Configurable by the administrator, thresholds are set for specific resources using Boolean operators to examine them. With WatchLAN, thresholds are set and continuously monitored for error conditions. Event notification is reported in a log and delivered to the administrator via either a Novell Send command, mail compatible with MHS (Message Handling Service), or a pager. Programs may also be executed in response to a particular event. NetTrack monitors the statistical performance of a file server, assisting the administrator in locating network bottlenecks. Statistics are presented in real time as average, peak, and accumulative levels.

XTN was the only product tested that can back up and restore a NetWare server's Bindery and other system files from a floppy disk, hard disk, or network drive. It does not, however, back up the data that is stored on the server's volumes, which is why XTree has bundled POWERsave with XTN. Most existing networks already have a backup system in place, but if yours doesn't, XTN gives you two products for the price of one.

Installation was easy, and documentation was complete. The statistics are aimed mostly at the server level and not at the network as a whole, but even without the ability to distribute or gather a list of software to clients, XTN can still be considered a strong first showing. □



Network Edition

THE LATEST NETWORK PRODUCTS AND MANAGEMENT TECHNIQUES

PRINT SERVERS

Multiprotocol Printing

Don't buy separate printers for your PCs, Macs, and Unix systems. Buy a multiprotocol print server and save money and space.

By Tony Pompili

In the '80s, the only limitation on multiprotocol printing was the strength of the printer stand. You just rolled in a separate printer for each network. Now, in the lean '90s, printers are faster, and PCs, Macs, and Unix hosts share the same network cables and file resources. Because of this, they should also use the same printer. We looked at external multiprotocol print servers—devices about the size of a hard-back novel—that speak Novell's IPX plus the TCP/IP network protocols. Through support of these two protocols, they can support most PCs, some Macs, and 90 percent of all Unix systems. Some devices also add Apple's EtherTalk and Digital Equipment's LAT protocols. When you connect one of these boxes to an EtherTalk network, for example, it acts like a NetWare print server, a Unix remote

printer, a Mac printer, or a LAT printer.

External multiprotocol print servers are lifesavers for older, less network-savvy printers. They allow you to leverage your investment in the printer while improving your network's capability. In our testing, we found several solid products that can be easily integrated into existing networks

that connect a mix of PCs, Macs, and Unix hosts. As you'll see, the Unix choice is the most complex, and your buying decision will probably be driven by your specific Unix requirements. We also discovered that most products still lean toward a single favorite type of platform for installation, diagnosis, and monitoring.

Generally, the designers of these products take standardized network management seriously and support SNMP. The result is a bevy of solid devices that can support mongrel networks using a variety of operating systems and computer architectures.

THE PRODUCTS

PC Magazine evaluated seven external multiprotocol print servers. Priced

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Before Boundary Routing,[™] Bank was being held



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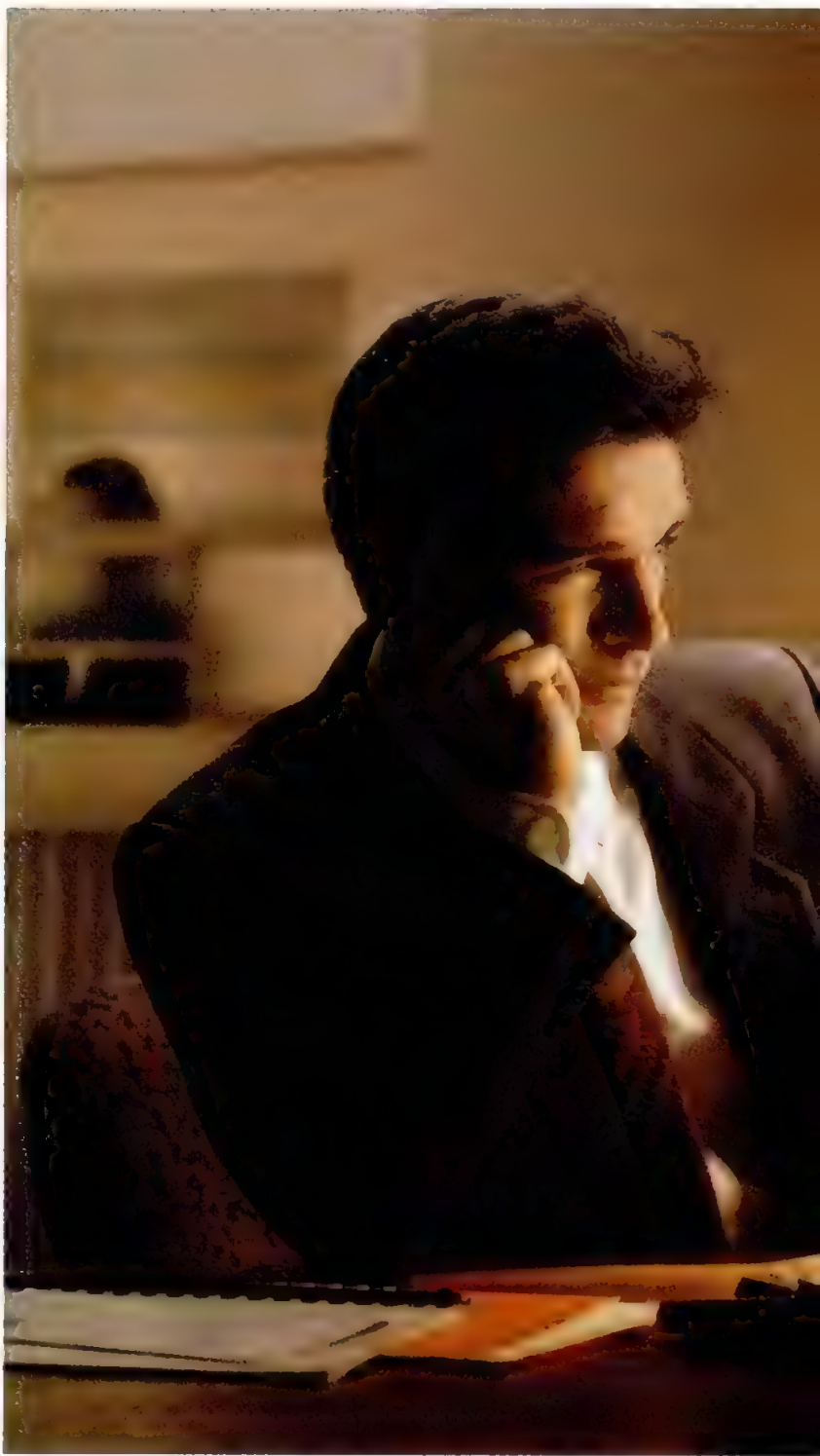
bandits, the thief bankers fear most is time.

Lose a day here and a day there, when updating loan and mortgage information, and you just might lose a few customers, too.

For United New Mexico Bank, heading that problem off at the pass led to a unique and innovative remote office networking system from 3Com called Boundary Routing System Architecture. With 3Com's Boundary Routing technology installed, all of United New Mexico's 28 branches receive up-to-the-minute financial information. Without delay.

No technicians must visit the branches. No new network staff must be added. One network administrator at the bank's headquarters can handle it all.

"Before extending our network to the branch offices, changing master loan and mortgage documents was very time-consuming," recalls Dan Langenwalter, Vice President of Technical Services for the bank. "It took two to five days just to revise the software applications. We had to route update diskettes to each branch. And we had no control over



the United New Mexico up on a daily basis.



what happened to the diskettes once they got there. Someone could slip them under a pile, and they could be lost for weeks."

Now, Langenwaller proudly notes, changes to the network are made within minutes, from headquarters, where the experienced network administrators are. And administrative costs have been virtually eliminated at the bank's remote sites.

"The result," he says, "has been the best of both worlds: the benefits of routing without the complexity."

Bankers aren't the only ones who have discovered that 3Com's Boundary Routing technology is the simplest and most cost-effective way to add branch offices to the corporate network. For a free video, *Plug and Play Remote Networking*, along with complete product information, call **1-800-NET-3Com**. You'll find answers to remote office networking problems that have been holding you up, too.



Networks That Go the Distance™

between \$600 and \$1,000, the products all supported at least Novell's IPX and TCP/IP, and most also supported Apple's EtherTalk. Each print server had at least two ports, usually a serial and parallel port. The products included ASP Computer Products' JetLAN/2P Plus, Axis Communications' NPS 550, Castle's LANpress 1-1, Emulex Corp.'s NetQue NATL, Lantronix's EPS1, MicroPlex Systems Ltd.'s M200 and M201, and MiLAN's FastPort 3000 and 3100. (We were unable to review Digital Products' NETPrint/200 or Intel Corp.'s NetPortExpress XL, since neither product was shipping at press time, but we do take a look at these products in the sidebar, "Enterprise Print Servers to Come.")

Because the differences in performance among print servers are minimal, we focused our tests on installation and management of print servers in an existing multiplatform environment. Although most print servers favor one platform for installation, diagnosis, and monitoring, we tested each print server on all available platforms. On the PC side, we ran Novell's NetWare 3.1 network operating system and a Windows 3.1 client. The Unix host was a Santa Cruz Operations (SCO) Open Desktop, Version 3.4 host. The Mac was a Quadra 800 running System 7.1. Everything was networked on an Ethernet II 10BaseT network.

SMOOTH NETWORK

NetWare installations were smooth and straightforward. Under NetWare, vendors can support print servers in two ways: either through PSERVER (Print Server) or through RPRINTER (Remote Printer). All of the products except NetQue supported IPX through PSERVER. (The NetQue's PSERVER software was in beta but should be in production by the time this article appears.) NetQue, as well as JetLAN, LANpress, and MicroPlex M201, supported NetWare's RPRINTER function.

Although slower than the PSERVER function, RPRINTER doesn't consume a NetWare user account, and it makes the box more flexible for those sites that use both PSERVER and RPRINTER network printing methods.

THE UNIX CHALLENGE

Installations under Unix and TCP/IP are the most challenging, but also perhaps the most useful. The basic delineation of the

two most prevalent versions of Unix—Unix System V and Berkeley Unix—is made more complex by other versions of Unix from manufacturers such as SCO, Sun, Digital Equipment,

and Univel. Most vendors of print servers supply installation instructions for various Unix systems for use with various versions of Unix, so remember to insure that a vendor supports your brand and flavor. Also, make sure the Unix system administrator is on hand during installation.

The value of TCP/IP printing, which is

largely associated with Unix, comes from both its wide support and its efficiency. Using a LAN analyzer, we were able to see that TCP/IP transmitted far fewer packets with less packet overhead than did IPX.

In our testing, we used SCO's implementation of the standard Berkeley Line Printer (LP) remote-printing daemon. This technique is supported in the firmware of all the products except ASP's JetLAN. We found the products that supported LP worked well, but during installation we had to update the firmware or software for every product. Most of the products use either erasable programmable ROM (EPROM) or flash memory, but the MiLAN and the ASP still use static programmable ROM.

ASP augmented the print server LP daemon with its own JetLAN daemon to provide greater control of the printer on each individual print server. Although all of the other print server vendors also provided proprietary services for compatibility with Unix, they supported LP printing as well.

Vendors use two basic print server architectures for Unix TCP/IP printing with the LP daemon. The first architecture puts considerable printing intelli-

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EDITORS' CHOICE

• Axis Communications' Axis NPS 550

Multiprotocol print servers are master mediators, bridging the printing actions of Unix, PC, and Macintosh computers. Since managers of multiprotocol networks buy these devices to gain flexibility,

we feel that our Editors' Choice should support a wide range of network communications protocols. Managers also want to connect, configure, and have the print server working in a matter of minutes.

Axis Communications' NPS 550 fits this bill nicely. Setup is a snap with the NPS 550's downloadable Unix BSD and System V script as well as straightforward NetWare and Mac EtherTalk installations. The NPS 550 supports all of the popular protocols, including IPX, EtherTalk, and TCP/IP.

Icing the cake is the NPS 550's flex-

ible Logical Printer feature used to customize printer-specific setup and end-of-job commands as well as to perform automatic conversion from ASCII to PostScript.

Axis' blind side to Mac print server management still gives it room for improvement. Lantronix's EPS1 comes in a close second because of its multiplatform management, which includes the Mac, the only product in this review to do so. But the EPS1 roll-your-own cabling kit for the serial cable is a nuisance that makes for onerous installations.

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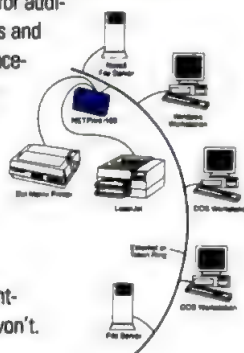
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NETPrint 100	Ethernet 10BaseT and BNC ThruNet 4/10MB Token Ring DDB and RJ45	Single Novell	1-parallel 1-serial 1-LocalTalk support	512K RAM 512K ROM	\$995 (S) \$795 (T)
NETPrint 150	Ethernet 10BaseT and BNC ThruNet 4/10MB Token Ring DDB and RJ45	Single Novell	2-parallel 1-serial 1-LocalTalk support	512K RAM 512K ROM	\$795 (S) \$1395 (T)
NETPrint 200*	Ethernet 10BaseT and BNC ThruNet 4/10MB Token Ring DDB and RJ45	Multiple Novell Apple	2-parallel 1-serial 1-LocalTalk support	512K RAM 512K ROM 2M RAM	\$995 (S) \$1495 (T)
JETXPrint 100	Ethernet 10BaseT and BNC ThruNet 4/10MB Token Ring DDB and RJ45	Single Novell	1-serial 1-LocalTalk support	512K RAM 512K ROM	\$995 (S) \$795 (T)
Local NETPrint 100	Ethernet 10BaseT and BNC ThruNet 4/10MB Token Ring DDB and RJ45	Single Novell	1-serial 1-LocalTalk support	512K RAM 512K ROM	\$995 (S) \$1195 (T)

*Available Q3/91 TCP/IP protocol Q2/92 IBM



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CIRCLE 859 ON READER SERVICE CARD

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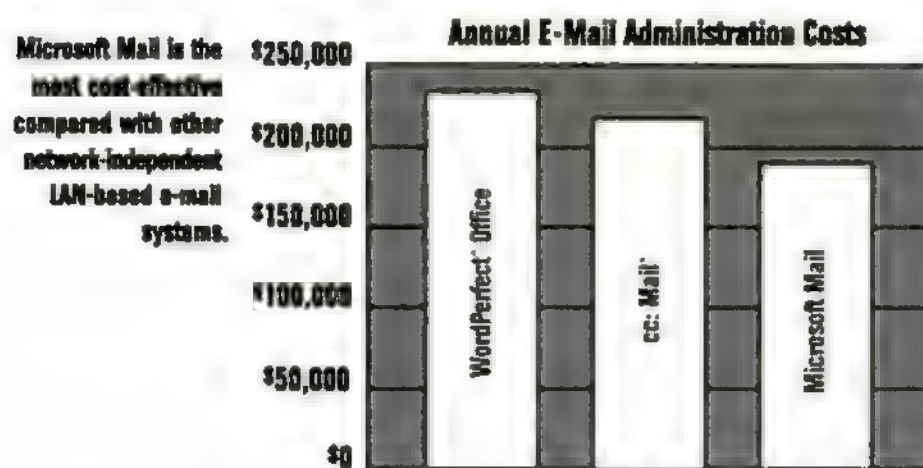
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HIGHLIGHTS

Multiprotocol Print Servers

SEVEN SERVERS WERE REVIEWED.

With print servers that support multiple protocols, PCs, Macs, and Unix stations can share printers. All seven we reviewed can connect to an Ethernet network, and all support Novell's IPX and TCP/IP. Other protocols offered are Apple's AppleTalk and Digital Equipment's LAT.

INSTALLATION IS EASY.

even though the configuration utilities vary for each device by protocol. Under NetWare, the PConsole printing utility is commonly used while under AppleTalk, the Chooser utility is used. The many available versions of Unix can make installation of the TCP/IP component of these print servers challenging. Nearly all of the products we tested support the standard Line Printer (LP) remote printing daemon.

SERVER MANAGEMENT IS DONE

by device. There is no single utility for managing and configuring multiple print servers. All the products we tested can be managed under PSERVER and PConsole, and some support RPRINTER. SNMP is the preferred choice for managing IP-connected print servers.

ALL THESE PRINT

servers offer multiple queues and multiple printers. All offer more than one printer port, and many use flash memory or erasable programmable ROM (EPROM) to upgrade firmware with enhancements and new protocols.

MANAGEMENT IS STILL SPECIFIC

to the network environment. Network managers familiar with NetWare may have trouble managing TCP/IP and AppleTalk printers, and those familiar with TCP/IP and AppleTalk may have difficulty with NetWare.

gence on the print server device itself. Axis and Lantronix use this model to set up logical printers with banner, header, and footer optional parameters as well as to define printer characteristics such as Printer Control Language (PCL) or PostScript and to store them in EPROM or FlashBIOS on the print server. This approach makes it possible to set up server profiles that other Unix clients attaching to the print servers can share.

The other approach, used by MiLAN and ASP, is to put much of this intelligence on the Unix host and to use customized software to interact with the LP and, in ASP's case, proprietary daemons. This approach gives each host the flexibility to create a variety of unique printing parameters specific to its needs. The downside is that you need to reconfigure each host's parameters rather than use existing profiles already resident on the print server.

In testing, we found that it was easiest to install, configure, and manage the print

servers that included some of the richer TCP/IP routines, especially TELNET and FTP. Using TELNET on products such as MiLAN's FastPort, for example, lets you have terminal emulation sessions with the print server, which are useful for setting up and verifying its operation. ASP's JetLAN, for example, allows installation and configuration of the box through its host-based programs, adding another layer of complexity.

MACINTOSH INSTALLATION

The Mac setup was the easiest. Just connect the box to the network and the print server shows up on the list of connected devices.

Macs working over LocalTalk carry on interactive conversations with PostScript printers, so print servers typically use a bidirectional serial port to extend the LocalTalk protocol connection to the printer. But serial communications are limited to 38.4 kilobits per second (Kbps) on even the fastest printers. The popular PC PostScript and PCL network printers

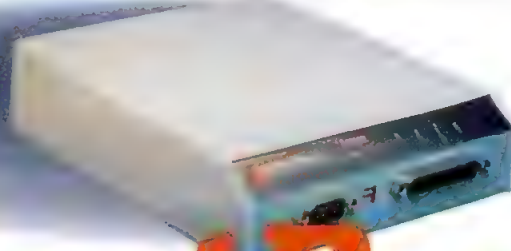
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CIRCLE 879 ON READER SERVICE CARD

■ Intel/Digital Products: *Enterprise Print Servers to Come*

Products from print server giants Intel Corp. and Digital Products Inc. weren't ready for this story, but both companies will have released multiprotocol print servers by press time. *PC Magazine* had an opportunity to look at pre-beta units from these companies, and here's what you can expect from these two market leaders.

Intel's newest version of its popular NetPort print server is the NetPortExpress XL. The XL includes TCP/IP and EtherTalk protocol support and contains two parallel ports and one serial port. The company began shipping the single-protocol IPX NetPortExpress mid-summer, and the XL should follow shortly.

The XL uses Intel's 80C186 16-bit processor running at 20 MHz. The parallel ports are compatible with Hewlett-Packard's Boise bidirectional specification for fast throughput. The XL also supports the Network Printing Alliance (NPA) specification for high-throughput parallel-port printing. The serial port runs at 57.6 kilobits per second (Kbps), faster than most print server serial ports available today, which typically run at 38.4 Kbps.

The NetPortExpress XL also lets you boot from a NetWare file server. This lets you reconfigure the XL by changing the boot code at the file server. This technique is particularly useful for installations that have a number of print servers because it obviates the need to log into each server and upload the code manually.

A proprietary Intel program lets you install the XL under NetWare, so you don't have to use Novell's PCONSOLE. On the Unix TCP/IP

side of things, the server supports the LP Berkeley Unix printing daemon and LP remote under Unix System V boxes. Intel also offers its own proprietary IPrint daemon.

The XL supports a rich array of TCP/IP suite programs including TELNET, FTP, ARP (Address Resolution Protocol), RARP (Reverse Address Resolution Protocol), and ICMP (Internet Control Message Protocol) but does not include SNMP management features for IP network management. For our beta unit, Intel supplied a program running under DOS with a NetWare-type C-Worthy interface for management and configuration. By the time the XL ships, Intel will have a Windows version of the monitoring utilities.

Intel will upgrade existing users with downloadable firmware for free. The upgrade will enable users to support the two new IP and Mac protocols. The XL for Ethernet costs \$599 while for Token-Ring it costs \$799.

Digital Product's new NETPrint/200 also joins the multiprotocol bandwagon supporting TCP/IP, EtherTalk, and IPX. Just hitting the market, the Ethernet version of the server is priced at \$995, and the Token-Ring version is priced at \$1,495.

Initially the NETPrint was one of the pricier boxes, but Digital Products believes that having three parallel ports and a 9-pin serial port that can double as a parallel port will be a boon for users needing

to provide multiprotocol print services to four printers simultaneously.

The three parallel ports are DMA-enabled and unidirectional. The NETPrint's parallel ports can extend the usual 10 feet limitation up to 100 feet using Digital Products technology. This lets you locate printers where you need them.

On the performance side, the company says that the ports can sustain 600-Kbps throughput for high-performance printers. With many older printers able to support only 30 Kbps and new printers maxing out at 300 Kbps, this feature will be most useful to very complex, high-throughput installations.

Digital Products takes a traditional

approach to the installation of the NETPrint/200. On the NetWare side, it uses PCONSOLE to set up print servers and queues. The NETPrint only supports the NetWare Print Server architecture (as

opposed to also supporting Remote Printer, a feature that is common on existing competitive products). Digital Products will provide a diagnostic program, MS Doctor, to help pinpoint printing and server problems.

For users of Unix TCP/IP, the NETPrint/200 supports the LP daemon and the LP remote daemon, but does not provide its own proprietary printing system. Initially, the server will support a minimal TCP/IP suite, offering only RARP and ICMP. Like the NetPortExpress XL, the NETPrint/200 does not support SNMP.

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work efficiently through their unidirectional parallel ports. Lantronix's EPS1 only supports EtherTalk on the serial port. MiLAN's FastPort 3100X can make a parallel port connection to the printer while responding to the Mac with preloaded information on the printer's capabilities.

MANAGEMENT AND CONFIGURATION

Once you've committed to piping all printing through a single printer, it's important to insure that the printer and server are up and running. The Simple Network Management Protocol (SNMP) allows you to verify that all the printers spread across the enterprise are in fact connected and working properly. Of the products reviewed, only MiLAN's FastPort 3100X and Castelle's LANpress 1-1 do not support SNMP for network management.

Unfortunately for those who want to

monitor the status of these boxes from the IPX or EtherTalk side, none of the products reviewed offers a systemwide, multi-platform monitoring tool. Users on large networks want to monitor critical functions (such as when the server and printer are on-line) from many client computers, but this capability simply isn't available yet.

Unix and TCP/IP connectivity are the defining elements of these products, but other factors (such as the number and type of printer ports on the device) are important, too. Use the individual reviews and the features table to find the products that provide the best fit for your multi-protocol network.

ASP Computer Products Inc.

ASP JetLAN/2P Plus

ASP Computer Products continues its strong user-friendly NetWare tradition

with the JetLAN/2P Plus while faltering in its foray into Unix and TCP/IP. ASP's nonstandard Unix printing implementation and confusing installation procedure will make it an unlikely choice for administrators from either the PC or Unix platform.

The JetLAN Plus comes in both a two-and four-port version. We evaluated the 2P, two-port model. The JetLAN supports TCP/IP and NetWare IPX but not EtherTalk. Its ports are parallel only: There are no serial connections. Priced at \$795, the JetLAN is one of the more expensive two-port servers evaluated.

The JetLAN was the most difficult of all the print servers tested in this review to install on our SCO Unix system. Unlike all of the other systems evaluated, the JetLAN does not support the standard LP remote daemon. It uses a proprietary JetLAND daemon and the

A Glossary of Print Server Terms

AFP (AppleTalk Filing

Protocol)—The networking protocol used to connect Apple Macintosh computers.

ARP (Address Resolution

Protocol)—The TCP/IP protocol used during connection between IP nodes. It enables a host to configure a new node by logging into another node using the Ethernet address.

BOOTP—The TCP/IP program that allows print servers and other devices to store network addressing information on the host.

daemon—A service or type of application that is called and used by other applications; used on Unix and other operating systems.

DMA (direct memory access)—A method for moving data in and out of memory at high speed without interrupting the activity of the CPU.

EtherTalk—Apple Computer Corp.'s networking protocol for running Macintosh computers over Ethernet.

FTP (File Transfer Protocol)—The program used to move files among IP hosts.

ICMP (Internet Control Message

Protocol)—The TCP/IP protocol used with the Packet Internet Groper (PING) command to verify that a specified host is on the network.

Internet—An international network of government, university, and commercial hosts communicating by means of the IP protocol.

Internet Packet Exchange (IPX)—

The NetWare network protocol for LANs.

LAT (Local Access Terminal)—

The Digital Equipment Corp. terminal-server protocol that is used to connect terminals to a network.

LPD (Line Printer Daemon)—The Berkeley Standard Distribution Unix program or daemon used for printing to local and remote printers.

net mask—The number in the address used to segment IP networks into smaller IP subnetworks.

PSERVER (Print Server)—A

NetWare specification for queuing and printing NetWare print jobs. PSERVER runs on a NetWare file server or as a standalone print server.

RARP (Reverse Address Resolution Protocol)—Part of the TCP/IP suite; the method by which a device assigns itself an IP address on boot-up.

RPRINTER (Remote Printer)—A NetWare specification for queuing and printing NetWare print jobs. RPRINTER is usually run on a shared or dedicated PC.

RSH (Remote Shell)—A method of printing remotely through TCP/IP by executing print commands from a remote host.

SNMP (Simple Network Management Protocol)—A network management protocol for monitoring hubs, routers, bridges, and other network devices; commonly used in IP environments.

TCP/IP (Transmission Control Protocol/Internet Protocol)—An open protocol suite for controlling communications and services between network devices; incorporated in Unix and now found in other operating systems.

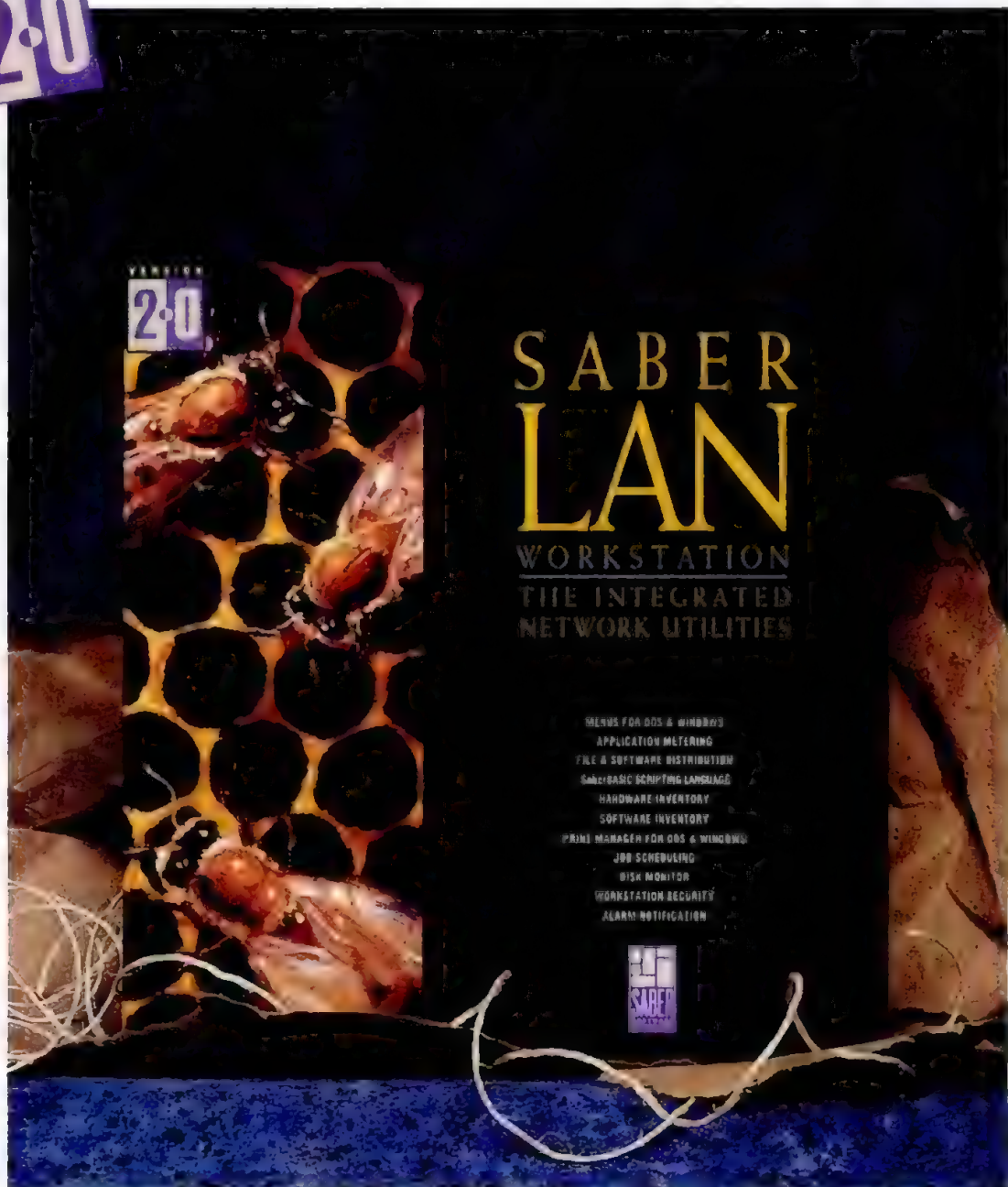
TELNET—A command and protocol for creating a terminal session with a remote host.

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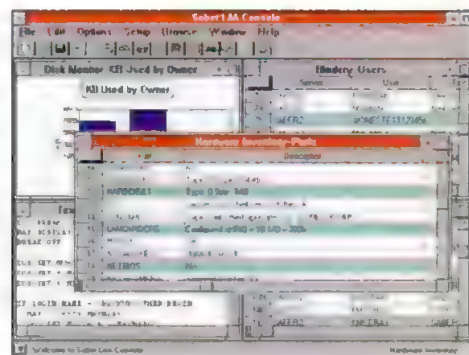
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Saber LAN Workstation is compatible with Novell NetWare, Microsoft LAN Manager, Banyan Vines, DEC PathWORKS, IBM LAN Server, Artisoft LANtastic, MS-NET based-networks and Windows for Workgroups. Saber Software Corporation 5944 Luther Lane Suite 1007 Dallas, Texas 75225 800-338-8754 or 214-361-8086 Fax 214-361-1882
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► SUMMARY OF FEATURES

Multiprotocol Print Servers

Products listed in alphabetical order



■ = YES □ = NO

	ASP Computer Products Inc. ASP JetLAN/2P Plus	Axis Communications Inc. Axis NPS 550 LANpress 1-1	Castelle Inc. Castelle NATL	Emulex Corp. Emulex NetQue	Lantronix Lantronix EPS1 M200/M201	MicroPlex Systems Ltd. MicroPlex 3100X	MILAN Technology Corp. MILAN FastPort
Price	\$795	\$695	\$599	\$889	\$695	\$795	\$995
Protocols supported	IP, IPX	Ethertalk, IP, IPX	IP, IPX	Ethertalk, IP, IPX, LAT	Ethertalk, IP, IPX, LAT	IP, IPX	Ethertalk, IP, IPX
Hardware Configuration							
Printer ports	2 unidirectional	2 bidirectional	1 unidirectional	1 bidirectional	1 bidirectional	1 unidirectional	1 unidirectional
Communications ports (speed)	None	One RJ-45 (38.4 Kbps)	One 9-pin (38.4 Kbps)	One 9-pin (115 Kbps)	One 9-pin (115.2 Kbps)	Two 9-pin (38.4 Kbps)	One 9-pin (38.4 Kbps)
Size of buffer	256K	4K	64K	150K	4K	4K	12K
Type of firmware	PROM	EPROM	EPROM	FlashBIOS	Flash PROM	EPROM	ROM
Type of processor	Intel 80188	National Semiconductor NS32C616	Motorola 68302	Intel 80186	National Semiconductor 32C616	Motorola 68000	Intel 80186
Type of network connections	BNC, RJ-45	BNC, RJ-45	BNC, RJ-45	BNC, RJ-45	AUI, RJ-45	AUI, BNC, RJ-45	AUI, BNC, RJ-45
NetWare printing modes	PServer, RPrinter	PServer	PServer, RPrinter	RPrinter	PServer	PServer, RPrinter	PServer
Software Configuration							
Unix printing modes	LPD	LPD, RTTEL	LPD	LPD	LPD, RTTEL	LPD, RSH, Socket	LPD
TCP/IP routines supported	ARP, BOOTP, RARP, TFTP	ARP, FTP, ICMP, TELNET, TFTP	ARP, ICMP, RARP	ARP, BOOTP, ICMP, RARP, TELNET, TFTP	ARP, BOOTP, FTP, ICMP, RARP, TELNET, TFTP	ARP, FTP, RARP, TELNET, TFTP	RARP, TELNET
Network management protocol offered	SNMP	SNMP	None	SNMP	SNMP	SNMP	None
Multiple printers per print queue	Yes	Yes	No	Yes	Yes	No	Yes
Miscellaneous							
Warranty	3 years	3 years	2 years	2 years	5 years	3 years	5 years
Installation/configuration software offered	Yes	No	Yes	No	Yes	No	No

Trivial File Transfer Protocol (TFTP) instead. ASP believes this provides tighter control of the printer. But in testing, we found that the JetLAN architecture's benefits may be overshadowed by some unusual installation and operational characteristics.

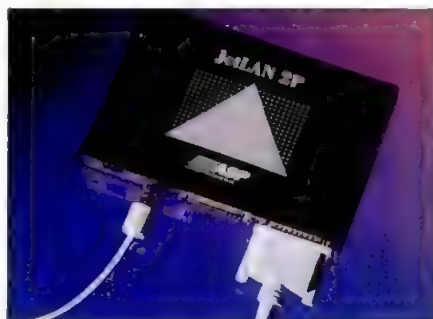
First, the printer description file has to be manually edited with three to five new lines of code. Every time you install a new printer, you must manually change the configuration. Second, the company sidesteps the traditional PRINTCAP file, storing printer, print server, and queue information in a separate file. Unix administrators who are accustomed to finding printer information in PRINTCAP will have to learn to look elsewhere. They will also have to add instal-

lation information to other files.

The advantage of the rigorous installation procedure is that it gives your Unix application a fair bit of control over the printer by forcing you to use SCO's printer description files, with which your application can define printer characteristics such as fonts, page

setup, and banner pages. Although few Unix applications take advantage of this feature, it's the next logical step for future applications.

Unlike products such as Axis Communications' NPS 550 and Lantronix's EPS1, the JetLAN has very little functionality on-board. Instead of using a print server console, ASP developed a front-end Unix program to provide an automated interface to the JetLAN Plus. Called JETLAN, the program is relatively friendly and lets you specify the IP address, server name, and Ethernet address. The program then automatically updates the server for you. The same utility gives you print status and print server configuration information.



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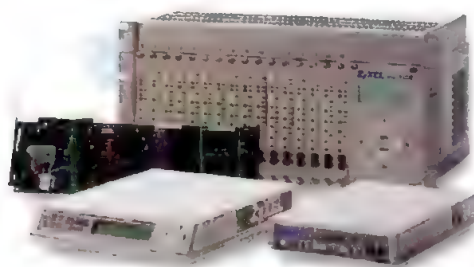
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After installing the program on Unix, installing the program on NetWare was a breath of fresh air. Like many of the other print servers, we used PConsole to set the various parameters. The JetLAN can be configured as either a NetWare print server or a remote printer. The JETLAN DOS utilities let you see the status of the server across the IPX network and let you perform tasks such as renaming the print server.

ASP Computer Products' approach of putting the printer intelligence in the hands of NetWare and Unix gives it some flexibility for future enhancements. But in the short term, the complexity of the Unix installation will make this product an unlikely choice for shops that have to do serious TCP/IP printing.

- List price: *ASP JetLAN/2P Plus*, \$795. *ASP Computer Products Inc.*, 160 San Gabriel Dr., Sunnyvale, CA 94086; 800-445-6190, 408-746-2965; fax, 408-746-2803.

Circle 959 on reader service card



Axis Communications Inc.

Axis NPS 550

The Axis NPS 550 Ethernet print server is a powerful device for every kind of printing need. It features simple setup from a Unix computer, a unique management program running under Windows, and a very flexible printer-configuration utility. The \$695 550 has one serial and two parallel ports and supports TCP/IP, IPX, and EtherTalk protocols. Its firmware is stored in flash memory so you can upgrade the unit through FTP from a Unix computer. Also, a unique downloadable Unix installation script makes installing the 550 on computers running either Berkeley or System V operating systems a simple task.

Under Unix, the print server supports LPD, RTEL (Reverse TELNET), and its own PROS proprietary printing method. The AXINSTALL program, downloaded from the print server's firmware, automatically sets up print queues, adds entries to



the PRINTCAP file, and prints. This was one of the simplest Unix installations of all of the products tested.

On the PC side, the 550 is the only product reviewed to have a Windows configuration application. Called AXCFG, it provides a way to change basic print server parameters such as the server name. The NPS is installed into NetWare with PConsole. As for the Mac, well, just open the Mac's Chooser and select the 550

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from the list of available print servers.

You monitor and configure the NPS 550 through the print server console. You connect to the console through a TELNET session or a terminal connected directly to the serial port. This arrangement precludes PC and Mac platforms that don't have TCP/IP from accessing the full features of the program, something not all network administrators will appreciate.

The console lets you do the standard stuff like change the IP address, configure ports and show the status of the ports. Its unique account command keeps track of the last 10 jobs printed through the server, the names of users, the protocols used, and the size and status of files. This is nice for following short audit trails and troubleshooting.

The 550's eight logical printer configuration functions help you create custom printer configurations and then associate them with any port. In addition to sending codes before and after jobs, logical printer configurations can also define automatic string substitutions and a secondary

printer to use if the primary printer is busy. One logical printer function automatically converts ASCII text to PostScript. Because the logical printer functions reside on the server, any Unix, PC or Mac client can use them.

The features and easy installation of the 550 make it a good choice as a multi-protocol printing solution, particularly for the Unix beginner. The Windows management utility, although it is limited, is unique and valuable.

• List price: Axis NPS 550, \$695. Axis Communications Inc., 99 Rosewood Dr., #170, Danvers, MA 01923-9837; 508-777-7957; fax, 508-777-9905.

Circle 950 on reader service card

Castelle Inc.

Castelle LANpress 1-1

Castelle has taken its extensive experience in the PC networking arena into the TCP/IP world with the LANpress 1-1. Offering very basic print server features at



\$599, it is the least expensive product in our review and provides good value in NetWare-oriented installations. It does not support EtherTalk for Macintosh printing, and there's very little monitoring or management that's available.

As the name implies, the LANpress 1-1 comes with a serial and a parallel port. Castelle makes the LANpress in two other configurations: a 2-2 with two parallel and two serial ports and a 1-3 with one

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parallel and three serial ports.

The PC roots of Castelle's LANpress really show through in the LANpress family. NetWare-trained administrators will feel at home. The company provides a utility called CPADMIN to set up the LANpress as a NetWare Print Server or Remote Printer. CPADMIN uses the familiar NetWare pick lists and nested menus of the NetWare's C-Worthy interface to guide the installation. The program allows you to change NetWare-related parameters such as the print server's name and the file server's name as well as changing basic print server settings such as the serial port attributes. You can also use NetWare's PConsole to install the LANpress.

In contrast to the print server vendors from the Unix world, Castelle emphasizes Unix and TCP/IP installation far less than it does NetWare installation. A small brochure, in lieu of a manual, generally outlines the use of the Castelle Unix installation script, but the description is pretty lean. However, in our installation the LANpress 1-1 came up and worked fine with the Unix LP remote-printing daemon.

While installation is a snap, Castelle needs to work on the program it provides to manage the print server. Unlike the other products reviewed, the print server configuration is accomplished entirely from the PC through a command-line DOS utility called LPCONFIG, which is incredibly clumsy. It expects you to type LPCONFIG plus the LANpress serial number and then the actual string of parameters for every command before you hit Enter. On the upside, savvy network managers will certainly create batch files to configure any LANpress devices on the network. Hide these batch files behind any third-party menu program and you've got a slick system, but that's asking a lot of the network administrator.

There is very little monitoring or management available through the LANpress. You can't tell if a printer is on-line or whether data is even moving through a specific port. This is a real problem if you're trying to monitor several of these boxes from a central location.

The LANpress will work best in environments needing a little TCP/IP and a



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lot of NetWare. Hassle-free installation is balanced by shallow Unix support and a lack of Mac capability. More serious multiprotocol users will look for more in print server management than the LANpress 1-1 offers.

• List price: *Castelle LANpress 1-1*, \$599. *Castelle Inc.*, 3255-3 Scott Blvd., Santa Clara, CA 95054; 800-289-7555, 408-496-0474; fax, 408-496-0502.

Circle 961 on reader service card

Emulex Corp.

Emulex NetQue NATL

The Emulex NetQue NetWare AppleTalk TCP/IP LAT (NATL) is a multiprotocol print server that's easy to upgrade, making it a perfect fit for growing companies that might need more protocols down the road. In its most robust version, priced at \$689, the NetQue NATL supports all four protocols. Emulex is one of the few vendors to support high-speed ports, with a 115-kilobit-

per-second serial port and a bidirectional Boise parallel port that is compatible with Hewlett-Packard's LaserJet 4. The NetQue stores its programming on flash memory for easy upgrades.

You can buy the NetQue for \$599 with only the IPX protocol activated, but all the protocols are already built into the firmware. Users purchase the use of additional

protocols, each of which they can activate through a key code from Emulex. This architecture makes it convenient to add new capabilities to installed print servers while keeping down the initial cost of those print servers.

You install the NetQue under NetWare through PConsole. The NetQue comes with both PSERVER and RPRINTER, but we were unable to test the PSERVER implementation since

code was still in beta testing. Emulex expects to have it available by press time.

We installed the NetQue under Unix as an LP daemon printer by manually modify-

ing the PRINTCAP and HOST files on our test SCO host. Basic preset filters, called TEXT and PASSTHRU, support text and binary print files, respectively. Except for a header command specifically designed

to send language switching codes to printers such as the HP LaserJet IIIsi, the NetQue doesn't offer much in the way of printer header and footer information. Also, unfortunately, the NetQue only supports one LP daemon printer per server. To get around this, Emulex includes its own proprietary printing system, RPRINT daemon, to replace the LP daemon.

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NETWARE FEATURES

- Auto detects 8 queues on up to 8 file servers
- Can notify user of job completion and printer errors
- Supports encrypted passwords
- Shows status via Netware's PSC and PCONSOLE
- Installation program simplifies setup
- Auto detects and uses 802.3 and Ethernet II
- Auto detects and attaches to new file servers
- Simultaneous queue server and PSERVER modes

TCP/IP FEATURES

- Finds IP address from BOOTP, RARP, or memory
- Supports LPR, RSh, Rexec, and standard TCP/IP connections to any TCP/IP host
- Configure using Telnet, TFTP, or the serial port
- Supports secure hosts with list of allowable IP addresses and subnet masks
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- Shows estimated job completion time and throughput via LPQ command
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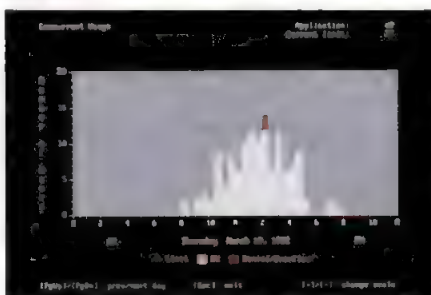
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03/19/92	09:01:43			JOHN	03/19/92 09:01:43
03/19/92	09:02:43			JOHN	03/19/92 09:02:43
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03/19/92	09:44:43			JOHN	03/19/92 09:44:43
03/19/92	09:45:43			JOHN	03/19/92 09:45:43
03/19/92	09:46:43			JOHN	03/19/92 09:46:43
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**FUNK
SOFTWARE**

CIRCLE 870 ON READER SERVICE CARD

System Requirements: AppMeter meters both DOS and Windows applications. Requires Novell NetWare 2.1x or above, or NetWare 386. Includes VAP and NLM. No TSR required.
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Funk Software, 222 Third Street, Cambridge, MA 02142 Tel (617) 497-6339 Fax (617) 547-1031

AppMeter

can configure and manage the print server and management tasks from either a PC running Emulex's TES IPX communications software or from a host system running TELNET. There is no Mac utility for the NetQue. The monitor command lets you closely follow a specific server attribute, such as the port status, to monitor the on-line or error state of the attached printers. Another monitoring feature, NetQue Counters, keeps track of bytes sent to ports as well as successful, and unsuccessful, network packet counts. All of these parameters are helpful in diagnosing printer problems.

The NetQue doesn't have the customized printer filters available in the NPS 550 or the Microplex M200, but NetQue is easy to install and has fast port connections for the latest printers. The unique upgrade capabilities of the NetQue make it appealing to buyers who want to start small but need room to grow.

• List price: *Emulex NetQue NATL: IPX only*, \$599; with *TCP/IP, IPX, EtherTalk and LAT*, \$689. *Emulex Corp.*, 3545 Harbor Blvd., Costa Mesa, CA 92626; 800-854-7112, 714-668-5416; fax, 714-668-6819. Circle 962 on reader service card

Lantronix

Lantronix EPS1

The ability to manage the Lantronix EPS1 from PCs, Macs, or TCP/IP-connected computers running Unix makes it a good fit for organizations that want distributed management and control. The server has rich configuration and monitoring firmware that helps administrators keep printers up and running no matter where they are on the LAN.

The EPS1 has one serial and one parallel port and supports the IPX, TCP/IP, EtherTalk, and LAT protocols. Lantronix only supports Apple EtherTalk printer connections through the serial port. Priced at \$695, the server's firmware uses flash memory so you can quickly update it through a

remote TELNET node across TCP/IP.

The EPS1's configuration and management utilities are very good. The unit can run a variety of configuration and status routines for functions such as showing the configuration of each port or setting IP addresses. A monitor command polls the server every 10 seconds and updates the status, a helpful feature for watching the progress of a job moving from the host through the print server to the port and printer. Typing the command "monitor queue" displays the source, port, status, and source system type of every print job every 10 seconds.



Lantronix made EPS1 very accessible and easy to manage. The EPS1 console is accessible from the PC with Lantronix's EPSCON program, from the Unix system with TELNET, and from the Mac with Lantronix's Maccon program. All of these programs use the same interface and commands, so controlling and monitoring the EPS1 from any platform is easy.

The DOS EPSCON program builds the NetWare configuration files for the EPS1, but you can also install the server through PConsole. Unix installation was not specific to our SCO Unix computer, although much of the basic information for configuring the Unix PRINTCAP and Unix files was helpful. The experience of a good Unix administrator comes in handy during installation.

The EPS1 is the smallest print server we tested, but despite its compact size, it has all the needed LED indicators, including those that show the status of links to the wiring hub and network and the activity on the parallel and serial ports. The biggest problem with this product, though, is that because of the size, the designers used an RJ-45 connector for the serial port. Thus, Lantronix expects

you to make the cable—a real challenge for almost everyone. If you aren't comfortable configuring the wires and snapping down an RJ-45 connector, then either get a dealer to do it or pass this product by.

Despite the cabling challenge it presents, the EPS1 does a great job at fitting into multiplatform environments with powerful, common interface management and configuration tools. Those companies with ethnocentric Mac, PC, and Unix administrators will find that the EPS1 has charms to soothe them all.

• List price: *Lantronix EPS1*, \$695. *Lantronix*, 26072 Merit Circle, #113, Laguna Hills, CA 92653; 800-422-7022, 714-367-0050; fax, 714-367-0287.

Circle 963 on reader service card

MicroPlex Systems Ltd.

MicroPlex M200 MicroPlex M201

The MicroPlex M200 and M201 print servers don't support Macintosh computers, but their flexibility earns them a place in any environment that includes IP and IPX. MicroPlex includes a feature called *flexible printer models* in both devices that makes customizing the

interaction of the printer and print server easy. The company also did a great job providing clear and comprehensive documentation so that even less-experienced Unix TCP/IP users could understand the product and the multiprotocol networking environment.

Priced at \$795, the M200 and M201 are identical except for their

network connections. The M200 offers a thinnet connection, and the M201 comes with a 10BaseT connection. The products each include two serial ports and one parallel port and use five LEDs to show network, status, error, parallel port, and power conditions.

The flexible printer models, similar to

MicroPlex includes a feature called flexible printer models in both its devices that makes customizing the interaction of the printer and print server easy.

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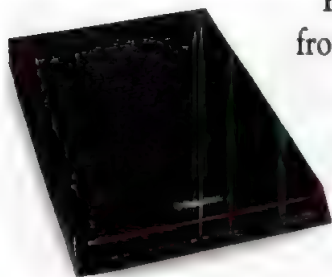


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CIRCLE 920 ON READER SERVICE CARD

the logical printer configuration functions in Axis Communications' NPS 550, customize the flow of print jobs to the printers.

These models contain functions such as commands to convert ASCII text to PostScript automatically or to switch a printer such as the HP LaserJet IIISi into PCL mode. You can assign a model to a port, and the port can be used by any NetWare or Unix computer. This type of architecture allows the network administrator to exercise central control over a few print servers rather than trying to customize many client computers. It can also help prevent many frustrating problems.

Installation is pretty smooth under PConsole, but there were a few rough spots. For one, you need to set internal



jumpers. These jumpers, however, also make the setting more secure than they would be otherwise by preventing people from fiddling with the system. The MicroPlex servers are also the only products we tested that came with a power switch. The switch makes resetting the unit easier, but make sure the switch is on when you try to print. Finally, you need to be sure that all port names used under NetWare are lowercase or the server won't recognize them. This is in contrast to NetWare's normally case-sensitive operation.

On the Unix side, the MicroPlex products support not only the standard LP daemon printing, but TCP RSH printing as well. The Unix installation process was straightforward and well-documented in a comprehensive manual.

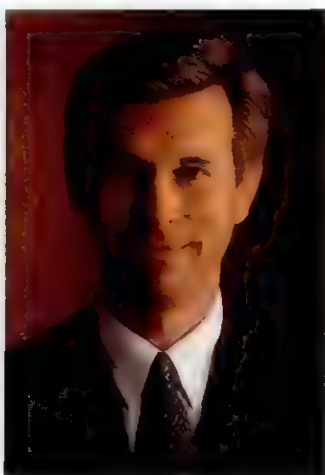
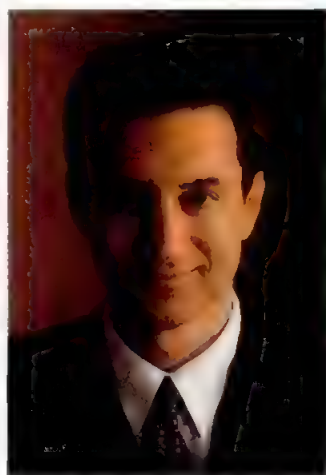
MicroPlex provides two configuration and monitoring methods, but they only run on a Unix TCP/IP computer. NPCONFIG, a menu-driven host-based program, leads administrators through standard configuration options including setting up ports, configuring models, and creating a log file on the host system.

The second method is the NPSH console that runs from the server itself. Accessed through TELNET, NPSH works similarly but uses a command line interface.

The MicroPlex M200 products are fairly easy to install and manage. Their ability to modify print jobs to match the printer makes them valuable in multi-platform installations.

• List price: *MicroPlex M200*, \$795; *MicroPlex M201*, \$795. *MicroPlex Systems Ltd.*, 8525 Commerce Ct., Burnaby, British Columbia, Canada V5A 4N3; 800-665-7798, 604-444-4232; fax, 604-875-9029.

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CIRCLE 871 ON READER SERVICE CARD

Sources, 6/93). Go ahead and link people to projects, notes to tasks, appointments to people and more, instantly. Commence's standard features include DDE Links to other Windows applications • Global Search • Letter Templates • Built-In Letter Writer • Powerful Import/Export Facilities • Auto Phone Dialer • Digital Telephony™ Support • Extended Sorting and Filtering • Built-In Gantt Charting

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MiLAN Technology Corp.

MiLAN FastPort 3000X

MiLAN FastPort 3100X

MiLAN Technology Corp.'s FastPort 3000X and 3100X appeal to even the most finicky Macintosh users with strong support for EtherTalk printing—even from the parallel port.

Both the FastPort 3000X and FastPort 3100X print servers feature one serial port and two parallel ports and support TCP/IP, IPX, and EtherTalk. The only difference between the boxes is that the 3100X attains greater throughput (up to 160 Kbps) by using direct memory access (DMA). This gives the 3100X performance similar to other DMA-enabled products we tested such as the Emulex NetQue NATL server. The other difference is the price: The 3100X is \$995, one of the most expensive servers in the group, while the 3000X is \$695.



Both FastPorts install under NetWare using PConsole. Since the NetWare Print Server emulation doesn't support unencrypted passwords, unencrypted passwords have to be set for every file server being serviced by the FastPorts. On the Mac side, as with most servers tested, just connecting the server to the network allows Macs to use the Chooser to select one of the EtherTalk ports instantly.

MiLAN was one of the few companies to provide detailed installation instructions for several specific Unix System V and Berkeley vendors, something that most NetWare users will really appreciate. The FastPorts support TELNET, making the process of interactively setting the initial IP address a simple task. TELNET also allows administrators access to the console for configuring and monitoring the print servers.

The 3000X series works hard at overcoming Mac EtherTalk parallel printing problems common to other boxes. Since the Mac likes to have two-way communications with the PostScript printer (although it's not required) and most parallel printers are unidirectional, the MiLAN 3000X tries to compensate. It stores specific information about the printer in its memory. When the Mac attempts to query the printer for font and printer feature information, it replies for the printer, speeding up the communications process.

A useful group of LEDs indicate power and network activity as well as activity on the parallel and serial ports. The FastPorts offer thin Ethernet, 10BaseT, and AUI connections in the same box.

The FastPort console interface is menu-driven rather than command line-driven as are many of FastPort's competitors. The monitoring capabilities provide on-line status, which helps to ensure that the server and printer are up and running, and making printer management easier. A display command provides a detailed screen of the server's settings, including firmware version, IP addresses, and port configurations.

MiLAN's attention to Mac details makes it a good choice for Mac-intensive environments. Unfortunately, the FastPorts can only be configured and monitored through TELNET. It would be nice if they provided PC and Mac console interfaces as well.

• List price: MiLAN FastPort 3000X, \$695; MiLAN FastPort 3100X, \$995. MiLAN Technology Corp., 894 Ross Dr., #101, Sunnyvale, CA 94089; 800-466-4526, 408-752-2770; fax, 408-752-2790.

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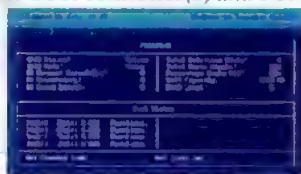
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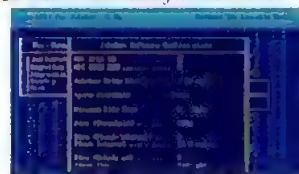


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FIRST LOOKS

HANDS-ON EVALUATIONS OF THE NEWEST NETWORK PRODUCTS

► ETHERNET SWITCHES

DragonSwitch Adds Ethernet Switching to the Access/One

BY JEFFREY D. BAHER

Ungermann-Bass (UB) jumps on the Ethernet switching bandwagon with the introduction of the ASM9108 DragonSwitch Ethernet switching module. The eight-port DragonSwitch module plugs into any of UB's Access/One chassis-based hubs and rounds out an impressive line of modules for the Access/One enterprise hub.

The DragonSwitch occupies two slots in an Access/One, which is currently available as a 2-, 5-, or 11-slot model, and offers eight 10-Mbps Ethernet channels. The DragonSwitch also offers advanced management capabilities that permit logical segmentation of the switching ports through UB's Virtual Network Architecture (VNA) technology. Despite the manageability VNA offers, however, the performance of the DragonSwitch comes up short.

Many vendors have embraced Ethernet switching in an effort to maximize the effectiveness of standard Ethernet. Like telephone switching, the technology utilizes a circuit-switch technology that supports parallel Ethernet conversations. Some vendors, including Alantec, Artel, and switching pioneer Kalpana, offer standalone Ethernet switches. Others, including Cabletron, SynOptics, Xyplex, and several other hub vendors, have announced plans to offer switching modules for their chassis-based hubs.

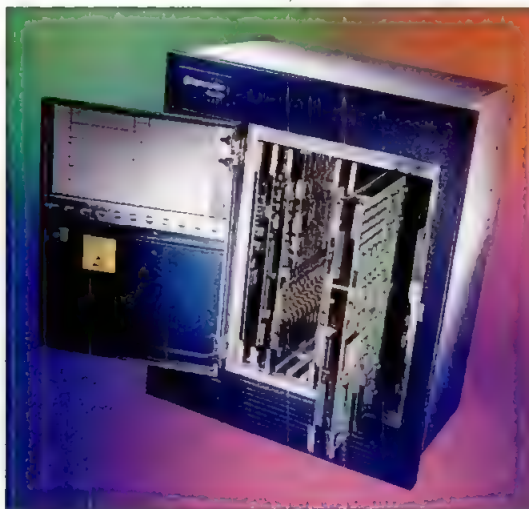
With the release of the DragonSwitch

for the Access/One hub, UB is among the first to develop such a module. While the option of Ethernet switching increases the value of the Access/One as an enterprise hub, it means little to users of other vendors' hubs. Despite the somewhat limited appeal of the DragonSwitch, however, it delivers some features currently not supported by other Ethernet switches.

Standalone switches, such as Kalpana's EPS 1500, typically lack the level of manageability that UB provides for the DragonSwitch. Most can be managed via SNMP, but the DragonSwitch also takes advantage of UB's VNA technology, which offers network managers greater flexibility in segmenting and configuring their networks.

VNA is designed to overcome the limited configuration options associated with traditional fixed-port hubs and bridges through a greater level of backplane segmentation. With VNA and UB's PlusBus switching backplane

Continues on page NE34



A DRAGON FOR YOUR LAN: UB's DragonSwitch module brings switching to the Access/One.

► UNINTERRUPTABLE POWER SUPPLIES

Keep the UP in Your UPS with APC's Matrix

BY STEVE BUEHLER

Uninterruptible power supplies (UPSs) are not usually considered leading-edge technology. Users perceive these large batteries as insurance policies to protect file servers and critical peripherals from power-line outages, voltage fluctuations, and line noise. But American Power Conversion now offers something new: the first modular UPS with SNMP support.

The midrange UPS market comprises

those products with sufficient battery power to keep several file servers up and running for about 10 to 15 minutes—enough time to do an orderly user warning and shutdown to minimize data loss. The power ratings of UPS units are measured in volt-amperes (va); as a general guideline, a UPS rated at 100va will adequately protect a computer rated at 70 watts. A typical midrange UPS provides from 3,000 to 5,000va [3 to 5 kilovolt-amperes (kVA)]

Continues on page NE36

Ungermann-Bass

CONTINUED FROM NE33

technology, users can easily create logical network workgroups or segments—each with their own guaranteed bandwidth. VNA can be applied to individual ports on a DragonSwitch to improve efficiency. For example, a user can create a virtual workgroup that consists of two ports on one DragonSwitch and three ports on another DragonSwitch. Devices in this virtual workgroup are isolated via the VNA configuration and communicate securely among themselves. While VNA is not a widely used technology, it is not exactly new. The Bytex Series 7700 and SynOptics 5000 hubs utilize similar virtual architectures, which is often referred to as per-port switching (as opposed to packet switching).

BUT HOW DOES IT RUN?

Despite the advantages of VNA, the DragonSwitch's performance was less than impressive during our testing. Using ZD Labs' NetBench 2.1 NIC Throughput test, we conducted two tests to evaluate switch performance. The configuration for the first test included three workstations and one server attached to each switch and hub with single-stream traffic (see benchmark test results). In this scenario, the Kalpana EPS-1500 and the Cabletron MMAC-M8FNB were the performance leaders, with the exception of the 64-byte block size, where all products finished in a dead heat. On the two largest block sizes, the Artel StarBridge Turbo also outperformed the UB switch, while the Cabletron—the non-switching hub we used as an Ethernet baseline—outperformed the UB on all block sizes.

When we introduced a second stream of Ethernet traffic into the original configuration and reran the test, the results were nearly identical. In fact,

only the hub's performance dropped off significantly. The Kalpana EPS-1500 was the performance leader, with the Artel a distant second. The Cabletron's poor

By checking CRC, the DragonSwitch reduces the number of bad packets, but reduces total throughput as well.

performance illustrates the inefficiency of traditional nonswitching Ethernet in environments with multiple streams of traffic.

The DragonSwitch's slow performance can be attributed in part to cyclic redundancy check (CRC), which is a form

of error checking. Every Ethernet packet has a CRC field called the Frame Control Sequence (FCS) that can be checked to monitor the transmission of the packet. When an Ethernet device receives a packet, it checks the FCS field. If the check fails, the packet is dropped and retransmitted. Kalpana switches do not perform CRC and, instead, forward all packets without error checking.

While this increases throughput, it does nothing to inhibit the propagation of faulty packets. By checking CRC, the DragonSwitch reduces the number of bad packets passed to the network, but reduces total throughput in the process as well.

UB has announced plans to offer a 16-port version of the DragonSwitch. Additionally, UB intends to expand FocusView, its family of management applications for the Access/One chassis and modules, to

include support for the DragonSwitch modules. Currently, FocusView is available only for the hub chassis itself, as well as the Ethernet and Token-Ring modules (see review in this issue, page NE36). By the time you read this, FocusView for the DragonSwitch should be shipping.

Overall, the DragonSwitch module is an excellent addition to the Access/One family of modules. Especially with the VNA technology, the DragonSwitch offers a level of manageability unparalleled by other available switches. Because of the slow performance, however, the DragonSwitch is probably not enough to win non-UB users over to the Access/One. These users are far more likely to opt for standalone switches—at least until other hub vendors provide switching modules for their hubs.

• List price: *Ungermann-Bass ASM9108 DragonSwitch*, \$7,200; *Ungermann-Bass Inc.*, 3990 Freedom Circle, P.O. Box 58030, Santa Clara, CA 95052-8030; 408-496-0111; fax, 408-970-7300.

Circle 969 on reader service card

Benchmark Test: Ethernet Switches

The primary limiting factor for switch performance proved to be the cyclic redundancy check (CRC). On both versions of the test, the Artel StarBridge Turbo and the UB ASM9108 DragonSwitch, both of which verify CRC, were slower than the Kalpana EPS-1500 EtherSwitch, which does not. As a nonswitching hub, the Cabletron MMAC-M8FNB does not verify CRC and therefore matched the Kalpana's performance on the single-stream test run. The Cabletron does not allow for multiple streams, however, and the increase in collisions during the dual-stream test run resulted in decreased total network throughput.

We used the **NIC Throughput** test from ZD Labs' NetBench 2.1 to measure the aggregate throughput of each product in both single- and dual-stream Ethernet environments. A stream is the flow of traffic between a server and a client. In the single-stream test run, one NetWare 3.11 server and three clients were attached to each of the switches and the hub. To test each product's ability to handle dual Ethernet streams, we attached a second server and three additional clients. The test run uses block sizes ranging from 64 bytes to 4K. We report the results in megabits per second.

NIC THROUGHPUT (Mbps)

Block size ►	64 bytes	512 bytes	1K	4K
Single - Stream				
Artel StarBridge Turbo	0.9	4.5	6.6	6.6
Cabletron MMAC-M8FNB	0.9	5.3	8.0	8.0
Kalpana EPS-1500	0.9	5.3	8.0	8.1
UB ASM9108 DragonSwitch	0.9	4.9	5.9	6.1
Dual - Stream				
Artel StarBridge Turbo	0.9	4.5	6.6	6.6
Cabletron MMAC-M8FNB	0.1	1.0	3.8	3.8
Kalpana EPS-1500	0.9	5.3	8.0	8.1
UB ASM9108 DragonSwitch	0.9	4.9	5.9	6.0

Higher scores represent better performance.



Until today the prospect of integrating a branch office into your corporate network has always seemed hopelessly far off. There are now unparalleled connectivity solutions that bring your branches and headquarters much closer together.

Eicon Technology, a world leader in PC-based connectivity, offers a family of internetworking and host access products for linking remote offices along with some of the best 3270, 5250 and APPC emulations for use on your favorite PC platform. Eicon's new InterConnect Server extends your Cisco, Wellfleet or IBM backbone network across the enterprise. It fuses traditional router and gateway technologies by integrating LAN intercon-

nection for Novell NetWare and TCP/IP networks, access to any host, as well as conversion and concentration of non-LAN communications—all supported by comprehensive SNMP network management.

So, if you are interested in connecting your branch offices—whether they are in San Francisco, New York, or anywhere else in the world—call 1-800-80-EICON for the Branch Office Connectivity booklet.



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CIRCLE 900 ON READER SERVICE CARD

BRANCH *office*
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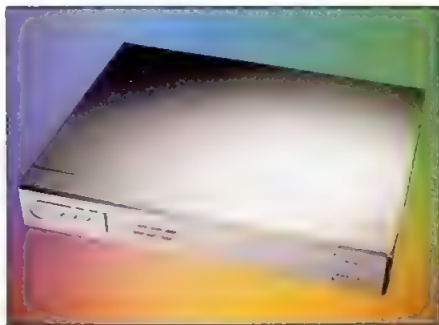
American Power Conversion

CONTINUED FROM NE33

of power, sufficient to protect 2,800 to 3,500 watts of equipment. Such a UPS will easily protect 5 to 10 file servers in a typical backbone configuration.

APC's Matrix UPS series comprises the 3kVA Model 3000 and the 5kVA Model 5000. Modules for the series include elec-

tronic controls that monitor the AC line and switch to the UPS batteries when necessary; an inverter, which converts the batteries' DC power to AC; and battery SmartCells, which are half the size of the main unit and can be stacked and daisy-chained together. These smart cells can



BUILDING BLOCKS: The modular Matrix provides flexible power protection.

be ordered and added individually to the Matrix, allowing administrators to provide the desired level of rundown time.

The modular configuration allows the possible points of failure in a UPS—the electronic control module and the battery cells—to be hot-swappable and thus removed and replaced easily without affecting the protection afforded the file servers or peripherals. Any single battery cell of the Matrix UPS weighs less than 70 pounds; it can be swapped out, replaced, and shipped via most delivery companies while the UPS remains up. Additionally, separating batteries and electronics reduces heat flow between these components, contributing to longer expected lifetimes than one-box solutions.

The advantages of modularity are also apparent during setup. Stacking and setting up these modules can be a minor challenge, but since the modules are relatively small, the process certainly requires less exertion than what's required to move heavier units with similar capacity from companies such as Best and Exide.

SNMP AND PROPRIETARY MANAGEMENT

Several UPS vendors, including Oneac Corp. and Tripp Lite, have begun to provide SNMP support for their products. The Matrix also offers SNMP support through a

notebook-size SNMP adapter. This 80286-based peripheral, available in either Ethernet or Token-Ring configurations, is a proxy agent that translates APC's proprietary UPS management information into standards-based SNMP objects. We installed APC's UPS management information base (MIB) under HP's OpenView platform, where it compiled and ran cleanly.

The APC MIB provides support for

UPS-standard event traps, including overload, discharge, and power loss. Additional traps and sets allow battery monitoring and execution of remote diagnostics. This SNMP support means you can manage your UPS along with switches, hubs, and routers from a

standard SNMP management platform.

As an alternative to standards-based SNMP management, APC also offers an updated version of its proprietary PowerChute PLUS software, available for NetWare (all current versions), Microsoft LAN Manager, AppleShare, Unix, HP-UX (Hewlett-Packard's implementation of Unix), or VAX VMS. PowerChute records UPS events, includ-

ing line voltage and fluctuations, in server log files. These log files can help a network administrator and the utility company correct potential power problems before file servers start crashing.

PowerChute PLUS also allows for orderly shutdown of protected file servers and identification of one master file server that will shutdown last, after all the others. This makes the software more efficient than other UPS management packages, including the ubiquitous PowerMON, which can handle only one or two server shutdowns.

For flexibility and growth, APC also provides optional plug distribution units (PDUs). These PDUs have differing plug setups to allow an administrator the flexibility to assign the Matrix UPS to protect file servers or peripherals with varied voltage and amperage needs.

If you need managed power protection today and the flexibility to increase your coverage tomorrow, APC's modular Matrix UPS provides fully paid insurance.

• List price: *American Power Matrix UPS: Model 3000, \$3,499; Model 5000, \$5,199; SNMP adapter, \$299; PowerChute PLUS software, \$99 to \$299; PDUs, \$199; American Power Conversion Corp., 132 Fairgrounds Rd., West Kingston, RI 02892; 800-800-4272; 401-789-1631; fax, 401-789-1631.*

Circle 966 on reader service card

► NETWORK MANAGEMENT

Ungermann-Bass Brings NetDirector to Unix

BY JEFFREY D. BAHER

Looking to expand its presence in the network management arena, Ungermann-Bass (UB) has brought its NetDirector application to the Unix environment. Originally designed for OS/2, NetDirector provides integrated network management as well as hub management for UB's Access/One enterprise hubs. Based on Hewlett-Packard's OpenView network management platform, it is an integrated network and hub management solution. The list price of \$15,995 includes HP OpenView, HP OpenView Network Node Manager, Access/One FocusView,

Access/One Ethernet FocusView, and Access/One Token-Ring FocusView.

NetDirector for OS/2 began shipping in January 1991 and is now installed in more than 2,000 Fortune 500 networks worldwide. Although both versions carry the NetDirector name, the two are quite different: NetDirector for OS/2 is entirely a UB product providing a UB network and hub-management platform. Version 17.0 was released in September 1993 and includes an IP address management tool, an IP auto-discovery and mapping tool, and an integrated SQL database (for device information and device groupings)

Continues on page NE38

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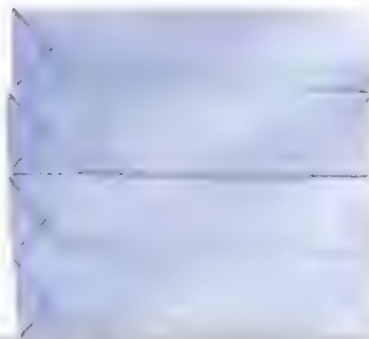
More paper going in.

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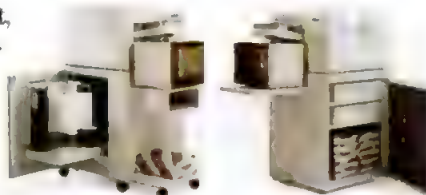


More paper nearby.

The HP LaserJet Printer Cabinet holds your printer, paper feeder, supplies, and—you guessed it—reams and reams of paper.

There's nothing terribly exciting about stacks of paper. Except that Hewlett-Packard's paper-handling solutions for the HP LaserJet III Si, 4Si and 4Si MX printers let you spend a lot less time dealing with them. And when it comes right down to it, why *save time* with a 17-page-per-minute printer if you have to *spend more time* putting paper in and taking documents out?

The 1,500-sheet HP Paper Feeder and HP LaserJet Printer Cabinet give network users double the input capacity plus a place to keep paper — where it won't get wrinkled or dog-eared.



For unattended printing, use the HP Paper Feeder with the 2,000-sheet HP Output Stacker*. It's the ideal solution for printing big jobs after hours.

If increasing productivity sounds more exciting than refilling paper trays, talk to your HP representative or reseller. Or call 1-800-752-0900, ext. 7889 for more information.



*Installation is required by HP authorized service personnel. © Hewlett-Packard Company 1983

Ungermann-Bass

CONTINUED FROM NE36

among its new features.

NetDirector for Unix, on the other hand, is a joint venture that combines HP's industry-leading network management platform, HP OpenView, with a set of UB graphical hub management applications. From a network management perspective, NetDirector for Unix is nearly 100 percent HP OpenView. It is only when information about UB hubs is needed that UB's contribution to NetDirector for Unix comes into play. This limits the appeal of NetDirector for Unix primarily to UB hub owners.

ACCESS/ONE FOCUSVIEW

To determine the value that NetDirector for Unix adds to HP OpenView, we loaded the UB MIBs using HP OpenView's MIB loader application—a straightforward process. After navigating through a few menus and network maps, we launched Access/One FocusView, the main hub-management application that depicts a graphical view of the selected Access/One enclosure.

The graphical display shows not only the number of slots on the hub but also specific information for each module, including module type and number, as well as status

and error information. Also available from this view is information on the Access/One's power supply, temperature, and fan, as well as a network utilization meter.

To obtain Ethernet module information, Access/One Ethernet FocusView can be launched from Access/One FocusView's View menu. Since all FocusView applications share an identical menu scheme, the same procedure can be followed for Token-Ring module information.

Access/One Ethernet FocusView provides a port-level graphical view of select-

ed Ethernet modules. This expanded view provides basic module information, Ethernet bus status, control (or management) bus status, temperature data, utilization figures, and network uptime. More specific information is available through the Ethernet FocusView's Configuration and View menus.

The Configuration menu provides port enable/disable functions, port-link test enable/disable capabilities, and counter functions. The counter function is particularly helpful in tracking Ethernet performance, including Ethernet collisions and non-collided packets.

Other convenient views for tracking Ethernet performance are available under the View menu. The default Performance view shows port-level attributes related to utilization and normal packets. For a different perspective, the Fault view offers two displays that relay port-level attributes related to error packets. The Fault status view includes bad-packet and collision information while the Fault Error view includes the number of late collisions, the number of alignment errors, and the number of Frame Check Sequence (FCS) errors.

Like the Access/One Ethernet FocusView, Token-Ring FocusView provides a graphical view of the desired Token-Ring module; basic module information such as slot number and model name; ring information, including ring speed and performance; and fault infor-

mation such as lost frames and token errors. Information regarding module temperature, MAC and LLC frame counts, and module uptime is also available.

Token-Ring module-specific information can also be found in Configuration and View menus. The Configuration menu provides both Normal and Forced insert, enable, and disable functions for inserting and removing devices from Token-Ring networks.

The default performance view shows port-level performance attributes including utilization and packet counts as well as LLC packets received and transmitted. The Fault State view, on the other hand, displays port-level information regarding operational state and insertion state. Finally, the Fault Error view displays the number of beacon detects as well as the number of FCS errors transmitted and received.

While UB's value-added features, the suite of FocusView applications, are full-featured and impressive, they are restricted to managing UB enclosures and modules. If you are already partial to products from Cabletron, SynOptics, or any other hub manufacturer, NetDirector for Unix offers little value beyond that provided by HP OpenView. The real value of NetDirector for Unix, like the DragonSwitch (see review in this issue, page NE33), is that it helps round out the features of the Access/One as an enterprise hub solution.

• List price: *NetDirector for Unix*, \$15,995. Ungermann-Bass Inc., 3990 Freedom Circle, P.O. Box 58030, Santa Clara, CA 95052-8030; 408-496-0111; fax, 408-970-7300.

Circle 967 on reader service card



PORT OF CALL: FocusView shows each port on an Ethernet module.

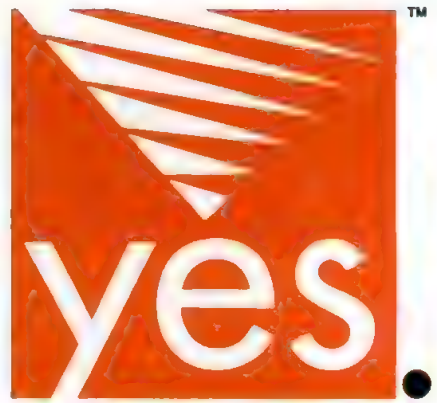


STAY IN FOCUS: FocusView provides details about the Access/One hub.



We invite you to discuss Network Edition articles and story ideas with PC Magazine editors David Greenfield and Frank Derfler in the Network Edition section of PC Magazine's Editorial Forum. Type GO ZNT:EDITOR from any ZiffNet or CompuServe prompt.

The Best Of The



\$89 suggested retail price, twisted pair version

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NE2000 COMPATIBLE

EtherXpert EP2000plus 16-bit ISA Ethernet Adapter Series

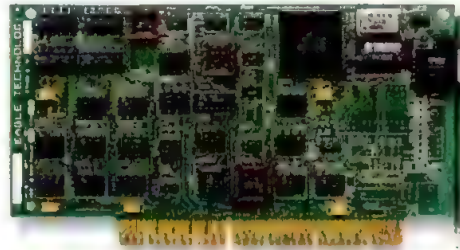
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- Easy to install and configure • High performance
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EtherXpert EP3210 32-bit EISA Ethernet Adapter Series

- The most cost-effective way to improve network performance for 386/486 EISA clients • The ideal companion for NE3200 server card • Easy to install and configure • Versions support thin coax and UTP cabling • NetWare and NDIS drivers included • Lifetime warranty • Unlimited Free Technical Support.



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\$199 suggested retail price, thin coax/twisted pair version

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► ROUTERS

Retix's Flexible But Pricy Unit for WANs

BY ROBERT P. LIPSCHUTZ

The link that connects remote offices to corporate headquarters is an umbilical cord that feeds the remote offices crucial information. These offices don't need an expensive, blazing fast router. What they need is a router that has the smarts to keep this umbilical cord connected and the information flowing. What they need is the Retix Router-Exchange Model 7250.

Despite having a slightly higher price than other peripheral routers, this sleek three-port router is made for remote LANs. It's got the right suite of protocols: IPX, IP, DECnet Phase IV, bridging, and Open Shortest Path First. It's got the right LAN connections: Token-Ring, Ethernet, and even an Ethernet hub card so it can double as a low-end hub. And it's got the right WAN connections with lines up to T1 speeds (1.544 megabits per second) running a proprietary High-level Data Link Control (HDLC) protocol or a standards-based Point-to-Point Protocol (PPP) for point-to-point links or X.25 or Frame Relay for packet-switched links. There's also an ISDN link for circuit-switched connections.

But best of all, the 7250 really shines in the way it creates and maintains the umbilical cord to remote offices. A dedicated processor monitors the remote lines, quickly routing network traffic around failed links.

Sites that use Retix's proprietary implementation of the HDLC will see some more benefits. Multiple serial lines, for example, can be combined for larger pipes and redundancy. Messages can be broken up and sent over these lines in parallel to save time. The remote router takes these messages and recombines them on the other side.

Data compression runs over the HDLC links, which can improve WAN performance by as much as 400 percent. However, currently, compression only works up to 256 kilobits per second, so you can use compression on your 56K

lines, but not on your T1 lines.

Another Retix extra is WAN error detection and correction. While most routers force the sending software application to retransmit a frame in the event of a line error, Retix has a different approach: The sending 7250, not the application, resends the packets, which are stored in its buffer. Once an acknowledgment is received from the adjoining router, the data is removed.

The 7250 is supported by a friendly user interface for management. Just hook a terminal or PC up to the console port and an easy-to-use menu system appears. All choices are logically grouped by protocol to aid in configuration. If you prefer managing your routers via SNMP, Retix has a network management pack that includes map icons and a large private Management Information Base (MIB) available for SunNet Manager.

Retix also provides an optional 10BaseT hub card for the 7250 that allows you to connect up to 12 Ethernet devices in small workgroups.

Of course, we cannot overlook the fact that even peripheral routers are

expected to push their share of network traffic, and the 7250 proved to be no slouch in our testing. Tests conducted using Retix software, Version 2.12, showed that the router could route IPX and IP and bridge traffic between two Ethernet segments at 100, 100, and 97 percent respectively.

Are there problems with the 7250? Absolutely. The first of these is cost: While the Retix product may provide some very sophisticated WAN connections, you'll have to pay. Second, the 7250 can't connect Macs running their native AppleTalk nor VINES workgroups using VinesIP. Open Systems Interconnection (OSI), the mainstay of the Retix product line, is not routed. Finally, the 7250's enhanced WAN functionality means locking yourself into Retix's proprietary version of HDLC. Still, the 7250 remains one of the most intriguing peripheral routers we tested, one that we would definitely recommend considering for your remote workgroup.

• List price: *Retix RouterXchange Model 7250*, \$5,000. *Interface cards: Ethernet*, \$600; *WAN*, \$1,000; *Token-Ring*, \$2,000; *10BaseT*, \$2,000; *management pack*, \$1,000/year. Retix, 2401 Colorado Ave., Santa Monica, CA 90404-3563; 800-255-2333, 310-828-3400; fax, 310-828-2255.

Circle 968 on reader service card

► X WINDOW

NCD's PC-Xware Rises Above the Competition

BY JIM CULBERT

Originally developed for Network Computing Devices' X terminals as Xware, PC-Xware provides your PC with the look and feel of an X terminal while allowing you to access your Microsoft Windows applications. In addition to doing an excellent job at allowing you to get double duty from your PC, the MIT X11R5-based PC-Xware features local windows management and built-in terminal emulation that set it apart from other PC X Window software.

Configuring X Window software can be a frustrating exercise since even simple applications often have dozens of setup

options. This is especially true of the X server software provided in packages such as PC-Xware. NCD's X-Services Console is a compact control panel tool built into PC-Xware that allows the user to change the server's configuration easily. The control panel is thoughtfully designed, providing quick and convenient push-button access to all options without taking up much space on the screen or requiring the user to navigate through a maze of menu selections and dialog boxes.

Many X Window programs for the PC are displayed and managed by the Microsoft Windows window manager. If you want to run a true X Window-based

Continues on page NE42

Modular UPS protection means unmatched reliability for 60% less cost

Introducing Matrix UPS for LANs, midrange systems

The challenge: eliminate the tough installation, burdensome service contracts, high lifecycle costs and threat of a single point failure that plague existing midrange UPSes.

The solution: Go to pieces. Package premium power protection in an innovative, intelligent, modular design.



Matrix UPS provides auto-shutdown support of all major network, and midrange OS and also supports SNMP and APC's Measure-UPS which meters temperature and humidity, and monitors smoke, fire, water, and security detectors.

Matrix modularity means reliability

In some midrange UPSes, a small internal failure can bring down the whole UPS, and your system with it.

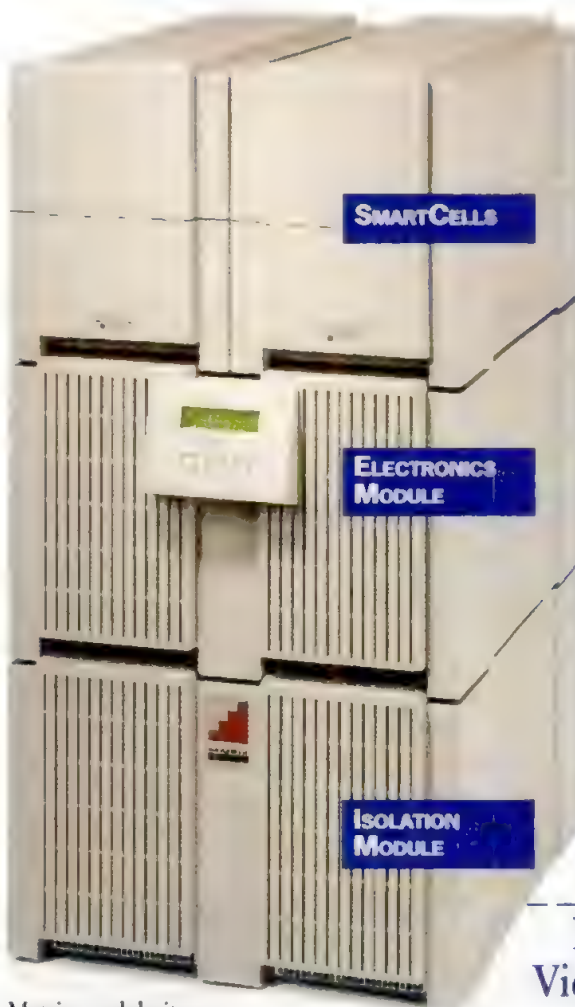
In contrast, the Matrix- "100% Uptime" design isolates any problems to their 'block' which can be diagnosed and hot swapped-out while the protected system stays up and reliable.

No downtime. No service delays. No unnecessary risk. The fact is, Matrix delivers plug-and-play reliability no other UPS can match.

Matrix modularity means low operating and lifecycle costs

When you're rightsizing to conserve cash, the last thing you need is a UPS that wastes it.

Small footprint and low weight (each module can be shipped overnight) means Matrix can be hot-swapped out by even untrained personnel without the cost or delays of a service call.



3000 and 5000 VA protect up to 22 servers or 2 midrange systems

■ Hot-swappable modules for 100% uptime, 60% lower lifecycle costs



■ Microprocessor-controlled, zero-maintenance SmartCells end expensive service contracts. For more runtime, simply add SmartCells.

■ SNMP support and automatic server shutdown (for NetWare, UNIX, NT, OS/400, VAX, Sun and more) protects data, lowers LAN support costs.

■ Environmental and power monitoring provides "glass room" level security.

■ Two-year warranty, \$25,000 Lifetime Equipment Protection Guarantee (see details)

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Matrix modularity doubles expected battery life, saving you replacement costs, and operates at 93% efficiency, so you save electricity and cooling costs as well. In fact, over a 5 year lifecycle, Matrix costs up to 60% less than same-sized UPSes... savings you can't afford to ignore.

Fax for your free video!

CIRCLE 915 ON READER SERVICE CARD

PC-Xware

CONTINUED FROM PAGE NE40

window manager, you must do so on a remote machine, which means that if the network suddenly jams or gets really busy, your display will become annoyingly unresponsive—or worse yet, will freeze outright. Recognizing the performance advantages of running an X Window manager locally, NCD included the code for it (ncdwm) in the PC-Xware program. Ncdwm can be configured so client windows conform to either Microsoft Windows or Open Software Foundation's (OSF) Motif style. OSF promotes industry standards and has developed Motif to provide a consistent look and feel for all X Window programs, including window managers. The performance of ncdwm was very good and was almost indistinguishable from OSF's Motif Window Manager (mwm) when we used Motif mode.

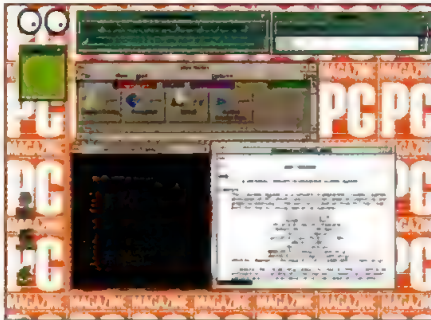
PC-Xware also offers a window management option that makes use of the Microsoft Windows windows manager. Using this option, all X client programs are shown in standard Microsoft Windows windows, which has its ups and downs. On the positive side, you only need to run a single window manager on your PC, which frees up memory and speeds up performance. Since Microsoft Windows was not developed for X Window, however, some programs may be distorted in the Windows display.

Conveniently, PC-Xware provides a local VT-320 terminal emulation program, useful because of the frequent necessity to log in to remote machines while working in the X Window environment.

PC-Xware also includes a built-in serial capability called XRemote, which was developed by NCD as a serial line protocol for communicating between X servers and clients over modem lines and other serial connections. While this is an exciting feature on paper, we found the perfor-

mance over the serial line to be unacceptable. Even with a 14.4-kilobit-per-second (Kbps) connection to a virtually idle, high-performance Unix workstation, applications responded so sluggishly that we found them unusable.

Still, the local window managers, configuration tools, and built-in terminal emulators help set PC-Xware apart from



BEST OF BOTH WORLDS: NCD's PC-Xware lets X Windows and Microsoft Windows coexist.

other X Window software for the PC. The XRemote feature is unique, but you can forget about using it to telecommute. PC-Xware also has some interesting remote-configuration capabilities but requires that the managed PCs are alive, on the network, and running

PC-Xware virtually all of the time. While this is realistic to expect from an X terminal, PCs frequently crash, are unintentionally powered down, and are even misconfigured.

One significant complaint we have is

the difficulty of installing the bundled networking software. NCD's documentation for troubleshooting the installation was scant. The company's support was responsive, but since the communications software was made by a third party (NetManage's Chameleon), NCD's technical support was only able to offer help for simple problems. We had to resort to blind elimination of entries in the CONFIG.SYS and AUTOEXEC.BAT files. We finally identified a conflict between a program loader (386Max) and the communications software, but found solving the problem an unnecessarily painful process.

Aside from deficient installation and configuration documentation, PC-Xware is a strong product. We were able to display both X Window programs and regular Microsoft Windows programs side by side on the screen without any difficulty. Our computer did indeed take on the look and feel of an X terminal—not just a PC struggling to behave like one.

• List price: *PC-Xware*, \$545. *Network Computing Devices Inc.*, 9590 SW Gemini Dr., Beaverton, OR 97005; 503-641-2200; fax, 503-643-8642.

Circle 972 on the reader service card

Driver Alert

The following table lists recently released software drivers and utilities from Microsoft, Gateway Communications, and Standard Microsystems Corp. This software can be obtained from Library 9 (SOS Driver Alert) of the Utilities/Tips Forum on ZiffNet. A complete source of network technical-support information, including technical articles, documentation, and supplemental software from leading manufacturers and software publishers, can be found in Support On Site, the monthly CD-ROM published by Computer Library. For information call 212-503-4400.

Filename	Size (kilobytes)	Release date	Description
3C527.EXE	32	27-Sep-93	Microsoft drivers for 3Com EtherLink/MC 32 Ethernet adapters
3C770.EXE	116	27-Sep-93	Microsoft drivers for 3Com FDDILink-F adapters
MADGNT.EXE	85	27-Sep-93	Microsoft drivers for Madge Smart 16/4 Ringnode adapters
OCTK16.EXE	77	27-Sep-93	Microsoft drivers for Olicom 16-bit Token-Ring adapters.
OCTK32.EXE	74	27-Sep-93	Microsoft drivers for Olicom 32-bit Token-Ring servers
P139XX.EXE	62	27-Sep-93	Microsoft drivers for Proteon P139x Token-Ring adapters
P189X.EXE	62	27-Sep-93	Microsoft drivers for Proteon P189x Token-Ring adapters
P199X.EXE	60	27-Sep-93	Microsoft drivers for Proteon P199x Token-Ring adapters.
TKXP16.EXE	77	27-Sep-93	Microsoft drivers for Intel 16-bit Token-Ring adapters
TKXP32.EXE	74	27-Sep-93	Microsoft drivers for Intel 32-bit Token-Ring adapters.
HCLHLP.EXE	156	23-Sep-93	Microsoft's Windows NT hardware compatibility list
GEMICBM.ZIP	81	7-Oct-93	Gateway Communications' drivers for its Micro Channel Busmaster adapters
E32144.EXE	97	21-Sep-93	Standard Microsystems' update to SuperDisk, Version 1.44, for Elite 32
EWS606.EXE	62	21-Sep-93	Standard Microsystems' drivers for IPX & NETX for 8-/16-bit Elite Ethernet 6.06 adapters
EN3502.EXE	21	21-Sep-93	Standard Microsystems' NetWare 3.1.x server driver for Elite Ethernet 5.02 adapters
EN4502.EXE	34	21-Sep-93	Standard Microsystems' NetWare 4.x server driver for Elite Ethernet 5.02 adapters



DigiBoard Is Your Best Connection To Remote LANs.

DigiBoard brings remote LANs closer together.

Whether you have an outside salesforce that needs access to data, road-bound executives that need their E-MAIL, or satellite offices that need to communicate on a regular basis, DigiBoard can help you make the connection. Anywhere in the corporate network. Anywhere in the world.

Wherever There's a Phone Line... You Can Extend Your LAN.

DigiBoard remote communication products install easily and provide high-speed connectivity through standard or digital (ISDN) phone lines. In fact, you can choose from a wide variety of products and connect over 1000 users through a single server without degrading performance. With DigiBoard, anywhere there's a phone line you can extend the corporate LAN.

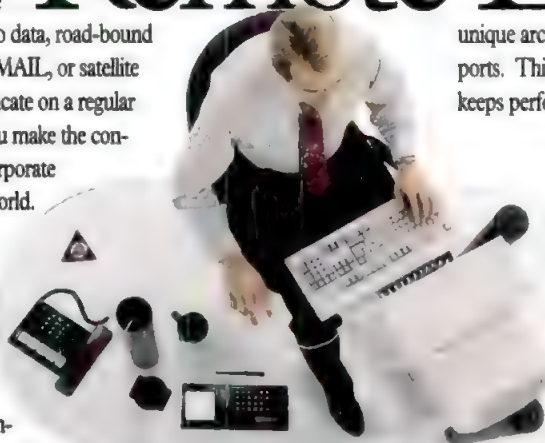
DigiBoard Makes Your World a Little Smaller and a Lot More Profitable.

As your world gets smaller, DigiBoard's intelligent serial boards can help make it more profitable. With an onboard front-end processor, these boards off-load processing requirements from your host CPU.

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► X WINDOW

AGE Logic's Xsoftware/32: Good, Not Great

BY JIM CULBERT

Like Network Computing Devices' PC-Xware, AGE Logic's Xsoftware/32 allows X Window and Microsoft Windows programs to run simultaneously on the same PC. The MIT X11RS-compliant software has some unique performance-tuning features and window management capabilities but lacks some of the convenient user interfaces found in PC-Xware and other X Window software.

Xsoftware/32 provides one unique feature: It allows the user to adjust performance by changing the position of a slider. By adjusting the slider, you can control the amount of system resources available to the X server. Claiming more resources for the server increases its performance but decreases the performance of other applications on your PC.

The software was very efficient even when configured for fast performance, using about 200K of memory to display a typical X Window session: two terminal windows, a clock, and a browser tool with a complex graphical user interface. Other PC-based X Window packages typically use twice this amount of memory for the same session.

Xsoftware/32 supports both remote X Window management and local management. Local management utilizes the Microsoft Windows window manager to manage X clients on your PC. If you want to run a traditional X Window manager, you must use the remote management option, which will perform poorly over a congested network. Since managing X Window programs with an X Window manager is preferable, we see the lack of a local X Window management program in

Xsoftware/32 as a weakness.

Using standard pull-down menus and dialog boxes, the user specifies the way in which Microsoft Windows windows and X Window programs share the screen by selecting one of two modes: multiple or single window. In multiple-window mode, each X client is displayed in a separate Microsoft Windows window, and thus X Window programs appear side by side with Microsoft Windows applications. Single-window mode is used when running a remote window manager, which displays client programs within a single Microsoft Windows window (which, in turn, acts as a separate desktop for X Window). Therefore, if you want to run a true X Window manager, you not only have to run it remotely but your X clients and Microsoft Windows applications will not be able to share the same desktop.

One positive feature of single-window mode is the capability to define a virtual screen. Using this feature, the desktop area used by the remote window manager is allowed to be larger than its display win-

dow. In fact, the user can specify virtual screen dimensions that are larger than the dimensions of any real computer monitor (up to 32,767 by 32,767 pixels). Scroll bars on the X Window desktop window allow the user to view different areas of the virtual screen. This can be a very useful feature, since many client programs will not easily fit on the average PC screen.

Overall, however, *Software/32* is not particularly impressive. It has few features that set it apart from other X software packages and is awkward to use in conjunction with remote window managers. Some of this awkwardness is expected to be corrected in a new release, which will reportedly hit the market within the next few months. However, the beta version that we saw displayed quirky behavior when running remote window management in multiple-window mode.

• List price: *Software/32*, \$495. AGE Logic Inc., 9985 Pacific Heights Blvd., San Diego, CA 92121-4337; 619-455-8600; fax, 619-597-6030.

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■ So, What is X Window Anyway?

The X Window protocol was developed at the Massachusetts Institute of Technology (MIT) in the 1980s as part of an educational computing project that would provide a windowing environment to work on different types of displays. The latest version, MIT X11R5, has become the de facto windowing standard for Unix workstations.

X Window programs are known as either servers or clients. Each computer with a display runs an X server program responsible for managing the use of that display. X client programs (applications) make screen-drawing requests to the X servers, which respond by rendering the requested shapes on their displays.

Conversations between clients and servers can be understood by any X server or client program and can either

take place within a single machine or over a network. In other words, client programs don't have to run on the same machine as the computer that displays their windows and graphics, and X clients can talk to X servers regardless of differing vendors, operating systems, or machine types.

To make effective use of X Window in a PC environment, your network must support TCP/IP. To put X servers on users' desktops, you can purchase Unix workstations, specialized X terminals, or X server software that runs on the PC.

Until recently, the overhead associated with running X server software was enough to cripple its use on the average PC. But today's cheaper, more powerful machines make PC X servers an increasingly attractive option.

► NETWORK / UNIX CONNECTIVITY

NetCon Eases the Tension Between NetWare and Unix

BY PADRAIC BOYLE

Until recently, sharing resources between NetWare and Unix environments required purchasing several software packages and loading special drivers and protocols on servers and workstations. Most of the time, this is a hassle for network administrators. NetCon Business Systems may have a solution. Its Unix software allows Unix hosts to appear to NetWare as file servers, providing a fast, easy way for PC workstations to communicate with both Novell and Unix printing and file services.

Available for Santa Cruz Operations (SCO) and Sun Unix environments, NetCon, Version 5.1, is cheaper than most NetWare-to-Unix packages, ranging from

\$995 for three users to \$6,995 for 255. NetCon offers DOS workstations the ability to utilize file and printer services as well as a multiscreen terminal emulator within a mixed Novell and Unix environment simultaneously.

The file sharing provided by NetCon is similar to Novell's Network File System (NFS), and the multiscreen terminal emulator is somewhat similar to SCO's server console, allowing for multiple virtual sessions and hotkey switching between each terminal. You may have up to 18 or more screens running at the same time under Windows, depending on the amount of memory installed at the workstation. NetCon also offers peer-to-peer capabilities among other Unix hosts on the same network.

By utilizing NetCon's own version of Novell's Internet Packet Exchange/

Sequenced Packet Exchange (IPX/SPX) and the NetWare Core Protocol (NCP), NetCon, Version 5.1, enables PC workstations on NetWare networks to gain access to Unix services without requiring that each of them load TCP/IP or NFS. In fact, because of the NCP calls, the Unix host running NetCon appears as a NetWare server under Novell's Slist utility. The NetCon software loads only onto the Unix host (or hosts) and is linked to an Ethernet or Token-Ring card that supports SCO link-layer interface (LLI) drivers or Sun native Ethernet. NetCon supports IEEE standards Ethernet 802.3, Ethernet II, and Token-Ring frame types, allowing the network administrator the flexibility to choose a single common frame type among all systems.

One drawback to NetCon is that it allows connection to Unix hosts only and requires that users have the same name and password on both the NetWare and Unix servers. In some network environments there are connections to other,

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non-Unix host devices that use TCP/IP, such as Digital Equipment Corp. VAX or Hewlett-Packard minicomputers and other systems that are only accessible via the Internet. These systems would not be accessible without the TCP/IP protocol. Some packages, such as Novell's LAN Workplace for DOS, allow connectivity to non-Unix hosts, but they are typically much more expensive and require additional software on each workstation to access Unix hosts.

Currently, NetCon does not read the user passwords out of the NetWare bindery. So NetCon must rely on the administrator to manually add users onto both systems with the same name and password. This is required for NetCon to establish the link between the two systems.

The installation requires knowledge of the Unix operating system and some NetWare experience. The procedure is simple to follow and offers a menu utility to add servers and users. We did run into a snag, however, while installing NetCon

on a Unix host on the same network with multiple NetWare servers. During installation, NetCon queries all of the NetWare servers on the network and reads the user names from the binderies into the Unix

Other packages allow connectivity to non-Unix systems, but require additional software to access Unix hosts.

host's memory. In a large network, this could mean reading thousands of names and placing a tremendous memory burden on the host. This was easily prevented by a call to NetCon technical support: We had to change a line in a configuration file and delete two data files. NetCon then requires you to add the servers and users that need access manually. Another way would be to isolate the Novell servers and

the Unix host onto the same network and allow NetCon to perform its automatic setup procedure.

NetCon requires SCO ODT/Unix 3.2.4 or 3.2.2 with streams, LLI 3.10g and the netconfig utility; Sun SunOS 4.1.1, 4.1.2, 4.1.3 with OpenWindows 3.0 and a minimum of 16MB (32MB is suggested) on the Unix hosts. Workstations require DOS 5.0 and Novell's ODI drivers, Version 1.20 or later. NetCon is also supported under Microsoft Windows 3.1 and Windows for Workgroups 3.1.

Even with NetCon's limitations, its ease of use, price, and—above all—its ability to communicate transparently within a mixed Unix/NetWare environment make it an attractive product for any network administrator who is thinking about combining the two operating systems.

• List price: *NetCon, Version 5.1*, \$995 to \$6,995. *NetCon Business Systems*, Five Progress St., Edison, NJ 08820; 908-756-3200; fax, 908-756-9220.

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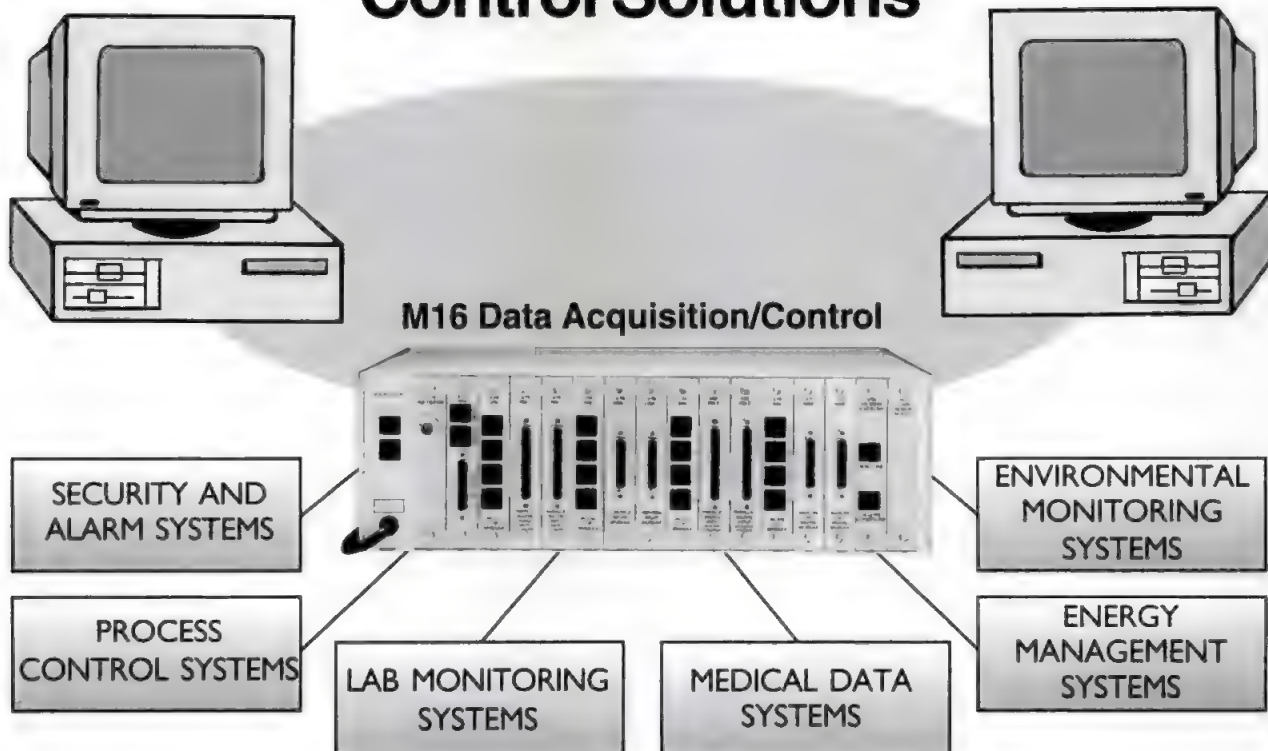
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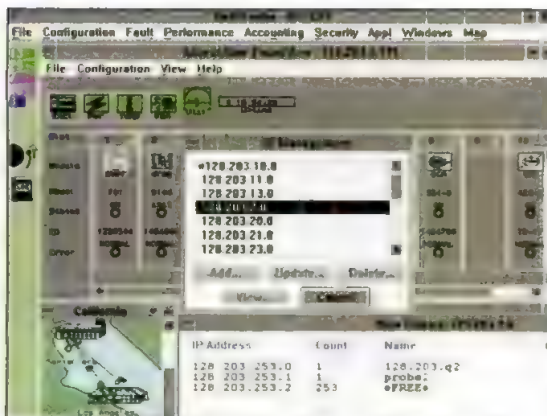
NEW & IMPROVED

NEWS OF ANNOUNCED NETWORK PRODUCTS AND UPGRADES

IMPROVED

UB Offers Automated IP Address Management

Ungermann-Bass simplifies costly administrative tasks with a new release of its network management platform. With NetDirector, Version 17.0, UB claims to reduce the cost of network ownership by simplifying and automating the tasks typically associated with LAN administration: assigning and tracking IP addresses.



TASKMASTER: Automatically assigns and tracks IP addresses.

NetDirector, Version 17.0, eliminates this time-consuming task by automatically assigning IP addresses as devices are added to the TCP/IP network. Not only does the platform assign the addresses, it also tracks them, detects duplication, and manages the entire process.

Another added feature is IP auto-discovery and mapping. In addition to adding the IP addresses to the database, NetDirector adds them to an icon-based topological map.

The combination of NetDirector client/server architecture, NetDirector's SQL database, and NetDirector/VNA domain management allows multiple network administrators to work together to manage the LAN.

• List price: *NetDirector, Version 17.0*, \$3,995 to \$17,500; *NetDirector/VNA for OS/2*, \$3,500 to \$8,500. Ungermann-Bass Inc., World Headquarters, 3900 Freedom Circle, Santa Clara, CA 95052-8030; 800-777-4526; fax, 408-970-7386.

Circle 952 on reader service card

NEW

Novell and Compaq Simplify Network Operation

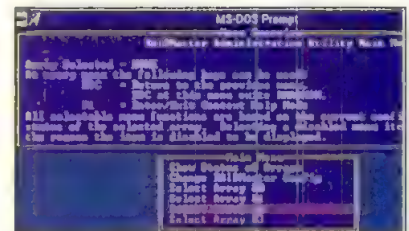
Novell and Compaq Computer Corp. recently joined forces to bring enterprise networking to network managers in a simpler, more manageable fashion. The agreement, called the Enterprise Computing Partnership, outlines a set of ideas for simplifying network operation and maintenance. Included in the agreement is a plan to speed the development and availability of NetWare for Compaq multi-processing servers. The resulting product is expected to be available in the second half of 1994.

Some of the issues involved in the venture include the implementation of joint marketing and sales programs, the codevelopment of integrated hardware and software solutions, and pre-certification of integrated platforms. The two companies plan to provide cross-training for their field sales teams.

• Novell Inc., 122 East 1700 South, Provo, UT 84606-6194; 800-453-1267, 801-429-7000; fax, 801-429-3944. Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269-2000; 800-345-1518.

HOT PROSPECT

Storage Dimensions Broadens Scope of RAID



Storage Dimensions now offers one of the broadest lines of RAID solutions for NetWare networks. This leading supplier of high-capacity storage systems introduced two products for RAID Level 5 data protection.

The LANStor RAIDMaster is a RAID Level 5 software solution for NetWare environments. It includes capabilities not usually found in typical RAID Level 5 packages: hot-swappable replacement of failed disk drives without interruption of data transfer, support for up to two spare drives, and data protection of data files and systems files.

The LANStor RAIDCard is a bus-mastering EISA adapter that provides fault tolerance and nonstop performance for NetWare networks. The RAID Level 5 controller includes LANStor DiskAlert, which provides automatic remote-paging and notification of workstation errors.

• List price: *LANStor RAIDMaster*, \$595; *bundled with a host adapter*, \$995 (EISA, Micro Channel), \$895 (ISA). *LANStor RAIDCard*, pricing to be announced. Storage Dimensions, 1656 McCarthy Blvd., Milpitas, CA 95035; 408-954-0710; fax, 408-944-1200.

Circle 951 on reader service card

NEW

Thomas-Conrad Offers Multiprotocol Management

Thomas-Conrad Corp. expands the range of its management structure products with the recent introduction of the Sectra Network Management System. This enterprise management platform combines Windows-based management software with a hub that accommodates multiple protocols, multiple segments, multiprocessing management, and a redundant power supply. Ideal for multiprotocol environments, the wiring hub supports four Ethernet or Thomas-Conrad Network System segments, four Token-Ring segments, and three Fiber Distributed Data Interface segments. Thomas-Conrad plans to incorporate additional protocols such as ATM, Fast Ethernet, and Ethernet switching. The software features a WYSIWYG hub display, hierarchical network maps, detailed reports, and alarm logs.

• List price: *Sectra Network Management System*, pricing to be announced. Thomas-Conrad Corp., 1908-R Kramer Lane, Austin, TX 78758; 800-332-8683, 512-836-1935.

Circle 953 on reader service card

NEW

Cabletron Hub Module Flaunts Flexibility

Cabletron Systems' new hub module, the Personal Computer Media Interface Module (PCMIM), offers added support for the Multi Media Access Center family of intelligent hubs and interoperability with multiple vendors and multiple technologies. The hub module integrates Ethernet and Token-Ring in a single module and features two additional EISA expansion slots. The PCMIM includes support for Fore Systems' ATM technology, NetWare, and Windata's wireless communication technology.

• List price: *Cabletron Personal Computer Media Interface Module*, \$6,995. Cabletron Systems Inc., 35 Industrial Way, Rochester, NH 03867-0505; 603-332-9400.

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PARTNERS IN CRIME: Supports multiple technologies from multiple companies.

IMPROVED

IBM Announces Multiple Product Enhancements

International Business Machine Corp. wants you to get more from your network, so it has added a variety of new functions to the 3746 Communication Controller and the CallPath product families. The 3746 Communication Controller Model 900 now features support for an additional 6 adapters (10 total) and twice as many physical devices (2,000 total). A Token-Ring coupler allows the controller to be connected to the 8250 Intelligent Hub via unshielded twisted-pair. CallPath focuses on voice processing (DirectTalk/6000) and computer/telephony (SwitchServer/2) integrated systems. DirectTalk/6000 will include new voice-recognition features. Enhancements to the SwitchServer/2 gateway will include links to three additional telephone systems.

• List price: *IBM 3746 Communication Controller Model 900*, \$37,400; *DirectTalk/6000*, \$16,000 to \$250,000; *SwitchServer/2*, \$10,000. International Business Machines Corp., Networking Systems Division, 1133 Westchester Ave., White Plains, NY 10604; 914-642-3000.

Circle 955 on reader service card

BRIEFS

ADAPTERS

DigiBoard's SyncPort/X.25 (\$1,995) supports Novell's Wide Area Networking Interface Specification (WANIS) and AIO (Asynchronous I/O) drivers. The intelligent, high-speed serial communications board provides two different forms of connectivity for Novell users: The WANIS driver allows Novell MultiProtocol Router users to access X.25 services, and the AIO driver allows NetWare Connect users to access X.25 services.

Eagle Technology introduced NE3210 (\$234), a 32-bit EISA card that includes ODI server and DOS ODI and OS/2 workstation drivers. The card includes support for thick, thin (AUI and BNC), and unshielded twisted-pair wiring. Used in conjunction with Eagle's NE3200 (a 32-bit intelligent bus-mastering card), it provides an EISA client/server solution for NetWare environments. 800-524-3245.

SWITCHES

Kalpana announced a new Ethernet switch for clustered-server environments. The Kalpana ServerSwitch provides the switching engine for Sun Microsystems Computer Corp.'s SPARCcluster 1 system. The combination of Kalpana's ServerSwitch technology and Sun's network file server provides network managers with increased response time, bandwidth, and connectivity. 408-749-1600.

Plaintree Systems' new Ethernet switches promise improved network performance as well as ease of installation and operation. The WaveSwitch 100 (starting at \$7,250) features 16 Ethernet ports and one or two ports for high-speed networking. WaveSwitch 400 (starting at \$9,125) features 112 Ethernet ports and up to 28 high-speed ports. 617-239-8077.

When it comes to high-performance hubs, the new DEChub™ 900 MultiSwitch is a whole different animal. For starters, it is the only hub with a technology-independent backplane that supports up to eighteen separate LAN segments, including Ethernet, Token Ring or FDDI in any slot. And with 3GB of throughput, it's ATM-ready today. The DEChub 900 MultiSwitch is the most flexible and cost-effective hub around. DEChub 900 modules, as well as the award-winning DEChub 90 modules, all work as single units or snapped into the DEChub 900 MultiSwitch backplane. And all DEChub modules are truly "smart"—just power them up and they know

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IMPROVED

Banyan's VINES 5.53 Increases Platform Support

Banyan Systems introduced the latest version of its network operating system, VINES: Version 5.53. The new release incorporates support for a variety of new platforms, peripherals, and configurations from companies such as Adaptec, AST, Cabletron, Compaq, Dell, Hewlett-Packard, and IBM.

VINES, Version 5.53, retains the features available in previous versions and includes support for popular RAID adapters, SCSI devices, tape drives, and LAN cards from the previously mentioned companies.

• List price: *VINES, Version 5.53, free, but only available to current VINES 5.x customers who subscribe to the Banyan Value Investment Program and require support for the specific platforms provided by this release. Banyan Systems Inc., 120 Flanders Rd., Westboro, MA 01581; 800-235-5332, 508-898-1000; fax, 508-898-1755.*

Circle 956 on reader service card

NEW

Microcom Releases Mouse Port—Powered Modem

Microcom recently announced a portable fax modem that eliminates the need for a separate power source. TravelPorte is a V.32bis modem that is powered through the notebook's mouse port adapter without disabling the mouse. The modem sports a lightweight design (8 ounces) and a speed of 14.4 kilobits per second (Kbps). It is also capable of speeds up to 57.6 Kbps by utilizing CCIT V.42bis and MNP 5 (Microcom Network Protocol) data compression.

Additional features include eight LEDs that indicate monitoring of modem activity and Password Connection Security (PCS) at a glance. The modem comes bundled with Delrina's WinFax LITE fax software.

• List price: *Microcom TravelPorte, \$329. Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062-5028; 800-822-8224, 617-551-1000; fax, 617-551-1968.*

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IMPROVED

Saber Readies Next-Generation Administration Utility

Saber Software Corp.'s Version 2.0 of its network administration utility focuses on user and services issues rather than the wire-related issues that are typically associated with network management packages. Saber LAN Workstation reestablishes the company's commitment to systems-oriented LAN administration.

In addition to focusing on issues such as network menus, software metering, and printer control, this latest release boasts a variety of new features. It provides network administrators with centralized file and software distribution; remote alarm notification; and SaberBASIC, a programming language designed to extend the current menuing language.

• List price: *Saber LAN Workstation, Version 2.0, \$179 (media and documentation); each additional node, \$39; upgrades for registered users, \$59 (media and documentation), each additional node, \$14.95. Saber Software Corp., 5944 Luher Lane, #1007, Dallas, TX 75225; 800-338-8754, 214-361-8086; fax, 214-361-1882.*

Circle 958 on reader service card



INS AND OUTS: *NetWare Bindery Viewer tells you who can login—and who can't.*

BRIEFS

BUSINESS NEWS

SynOptics Communications recently acquired Coral Network Corp. for approximately \$15 million. Coral's focus has been on developing and marketing high-end networking technologies, most notably the ILAN family of routers. SynOptics, a leading supplier of intelligent hubs, plans to capitalize on Coral's expertise in order to enhance its position in the high-end market. 408-988-2400.

Cisco Systems, noted for its expertise in the routing and bridging markets, announced the acquisition of Crescendo Communications. Crescendo's involvement with such key technologies as Copper Distributed Data Interface, Fiber Distributed Data Interface, LAN switching, and asynchronous transfer mode should help to further Cisco's dominance in the market. 415-326-1941.

Networks Systems Corp. acquired Bytex Corp. for approximately \$47 million. The agreement has been approved by both companies and is pursuant to the purchase of Bytex's outstanding stocks. Bytex will become a wholly owned subsidiary and business unit of Network Systems, which markets bridge-routers, channel extenders, and storage and backup solutions. Bytex's focus is on fault tolerance and switching. 612-424-4888.

Proxim's recently announced partnerships center on wireless networking communication. Proxim, a leading supplier of spread-spectrum wireless networking products, will integrate a new low-power chip from Raytheon Co. in its wireless PCMCIA-based products. The second announcement, a partnership with Fluke Corp., focuses on the integration of Proxim's ProxLink Radio Module in the Fluke Wireless Logger. 415-960-1630.



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Is the Router Market Doomed?

As I walked down those packed aisles at Interop, blitzed all around by the demonstrations of a plethora of ATM products, I couldn't help but hear the death rattle of the router industry. I know that sounds like heresy. For the past two years or more we've seen market leaders Cisco Systems and Wellfleet Communications become the darlings of Wall Street. Twice, *Fortune* named Wellfleet the fastest growing company in America, while Cisco now has a valuation greater than Digital Equipment Corp.'s.

But when you consider the combination of asynchronous transfer mode (ATM) at the high end of the market, switching at the midrange, and software routers at the low end, you will realize that while companies may need routing, they may not necessarily need routers. In other words, routing is software that is being run on hardware other than the highly specialized and proprietary platforms offered by the router vendors.

The first sign of the effect of this decoupling of routing software and hardware came after the latest Interop show. There I was—inundated with demonstrations of switching hubs and ATM products rather than demonstrations of TCP/IP and routers.

The result: Cisco's stock dropped nearly 25 percent based on Wall Street's fear that the company will find significant competition from switching hubs and ATM. Wall Street felt that Cisco's oligopoly status may be coming to an end. The stock has inched back up, but the thinking that led to this tremor will continue to plague the industry for months.

And for good reason. In the first year of production, local ATM networks' price/performance is between 10 and 100 times better than that of routers due to the ATM hubs' significantly higher packet-processing or cell-processing rates and lower cost. Similarly, switching hubs also represent a more economical, higher-performing solution than routers. Grand Junction Networks, based in Santa Clara, California, for example, is offering a 24-port Ethernet switching hub with both 10BaseT and 100-megabit-per-second Ethernet interfaces at about \$260 per port: 10 times less expensive than the equivalent routing solution.

SynOptics recently introduced its System 5000 hub, a hub-of-hubs product. The 5000 incorporates switching technology, allowing the hub to do what was previously the router's job: connecting all devices and workgroups into an



Cisco's stock dropped nearly 25 percent due to fear that its routers will compete with switching hubs and ATM.

enterprise network. The router is left being used only to connect LANs over WANs.

And there's every reason to believe that hubs will gain greater routing functionality. Hub manufacturers are starting to provide the most powerful enterprise management solutions in the industry. With physical and logical networking along with integrated network management in one device, managers can be more productive. This means you can reduce your people cost, which my research shows makes up 43 percent of most network budgets.

Just recently, SynOptics purchased Coral Networks, a start-up that makes high-end routers. Already, 3Com and Chipcom—both major hub vendors—either offer routers or have close ties with a vendor that develops routers, which makes them capable of moving routing software into their hubs.

While the high end of the router market will feel the heat in the next few quarters, there is a huge market for routing at the branch office level of corporate networks. In fact, by the end of next year there will be over a dozen firms with over 1,000 routers in their networks, most of which will be placed at remote offices. There will be fierce competition from both hub vendors with integrated routing and networking vendors that are providing routing software that runs on PCs. Novell is probably the best example of this latter category: Its MultiProtocol Router, Version 2.0, integrates routing and desktop interconnections into a NetWare server.

Router vendors aren't taking these challenges lightly. Cisco Systems and Network Systems Corp. have bought hub manufacturers Crescendo Communications and Bytex, respectively. Cisco has also introduced a line of low-cost hubs, and you can expect it to port its routing software onto a PC platform as well.

One thing is clear: These are heady times in the world of the network infrastructure. You'd better stop thinking of buying hubs and routers and start thinking of buying inter-networking hubs. In the next two years, there will be fewer distinctions between hubs and routers. The first tremor in the router market was no false alarm. It was a sign of things to come.

NICK LIPPIS IS A FREQUENT CONTRIBUTOR TO *PC MAGAZINE* AND PRESIDENT OF STRATEGIC NETWORKS CONSULTING, A CONSULTANCY SPECIALIZING IN ENTERPRISE NETWORKING. HE PUBLISHES *THE INTERNETWORK ADVISOR*, A MONTHLY NEWSLETTER.



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Systems vs. Components You Choose

David, once again you're stumping for the forces of top-down centralized planning. Only this time, you tout tightly integrated "systems" as the ideal manifestation of the network planner's art. Integrated systems don't come without compromises, and those compromises can either keep you from having the best systems or force you to pay for overkill.

Our savvy readers don't buy their audio and video components, for example, in one single slick cabinet because experience shows that they can enjoy better performance by selecting and integrating the pieces and parts themselves. Tuners, recorders, and videocameras all plug into each other and work together because they conform to certain standards. And our readers know that if two desirable components don't plug into one another, a manufacturer out there surely markets a cable or a box that can join them.

If you buy component products that conform to standards, you have a chance of reusing existing components, expanding your system in an economical fashion, and constantly upgrading your capabilities. If you buy top-down integrated bundles, you succumb to the horror that managers fought from the '60s to the '80s: the dreaded "account control," in which you are tied to an individual company. If you give up control of your systems, today's smiling salesperson will become tomorrow's devil holding your soul and your purse.

The network market still depends on an active sales channel of systems integrators who make a few bucks by creating customized solutions and, most importantly, by being there when things go bump in the night. Top-down integrated systems threaten this channel and our readers' source of support. Your integrated systems will quickly start to suffer from sclerosis of the support mechanism.

Dave, I'd rather buy hubs from Cabletron or SynOptics, servers from NCR or Compaq, adapters from 3Com or Standard Microsystems, remote access from Cubix or J&L, and network management from HP or VisiSoft than buy an integrated solution from any one of them. These companies should do what they do and do it well.

Forgetting what business you're in is the quickest way to be out of it.



Experience shows you can enjoy better performance by selecting and integrating the pieces and parts yourself.

Frank, imagine a hub that recognizes a user who has moved his or her machine to a different location and automatically reconnects that user to the same network, even the same server, no matter where he or she is on the enterprise network. Sounds like sci-fi, right? Not quite. It's a new function Chipcom is demoing for its Online Concentrator. The feature should be available in 1994, and it's just one of a series of developments that point to an underlying change in the way products are

being made and sold.

For the past two years, hub vendors, for example, have focused on selling individual components. Now, Frank, many of the biggest hub vendors are starting to sell systems. Instead of selling individual hubs into specific workgroups, they are starting to sell to companies that are looking to make strategic decisions that will improve

their organization's productivity by deploying networking throughout the organization.

Take a company, for example, that wants to allow customers to call in product orders and have those products shipped to them on a particular date. To implement this system, sellers must have a computing infrastructure that integrates information gathered from

The emergence of integrated systems and switching hubs means hubs will be sold as systems.

all facets of the organization—the remote sales office receiving the order, the manufacturing unit producing the product, and even the customers' own systems—for billing and shipping information.

This shift of focus from hubs to systems can be seen in a number of products. As I've pointed out before, Frank, logical workgroups and switches are probably the best example. Chipcom, SynOptics, 3Com, and Bityx are all providing hubs that allow a network manager to move users between networks hundreds of miles away. Management is also simplified by the virtual workgroup, a concept that allows network managers to group devices based on functionality and not based on simply location.

But there's still a lot more work for these vendors. If they are truly going to provide systems, network management for all infrastructure devices must be better integrated.

The network manager should be able to correlate the information that is gathered by the router with the information that is gathered by the hub. Only then, Frank, will we have a true network system.



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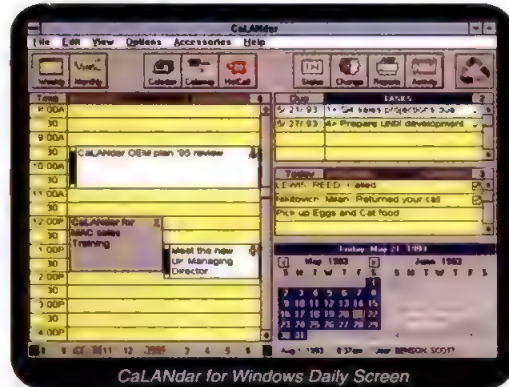
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User-to-User

BY NEIL J. RUBENKING

To Catch a Thief

Recently I suspected someone of using my work PC after I went home for the day, but I had no proof. To track the intruder, I wrote BOOTTIME.BAT, shown in Figure 1. BOOTTIME automatically records the date and time in a hidden file every time the PC is powered up or rebooted.

The statements that make up BOOTTIME.BAT can be inserted as a block directly into your AUTOEXEC.BAT file, or AUTOEXEC can CALL BOOTTIME.BAT. I prefer the latter, because I like keeping my AUTOEXEC.BAT concise for easier reading and troubleshooting, and it also allows BOOTTIME.BAT to remain self-contained and dedicated.

When BOOTTIME is executed, it writes the command SET currDate=%3 %4 to the file CURRENT.BAT. Then it writes the output of the DATE command, "Current date is Sun 02-14-1993," for example, to the file CURRENT2.BAT. CURRENT2.BAT's execution runs CURRENT.BAT with the third command-line parameter (%3) equal to, in this case, "Sun," and the fourth command-line parameter (%4) equal to "02-14-1993." The single line in CURRENT.BAT sets the environment variable currDate to "Sun 02-14-1993." A similar process sets currTime to the current time, say "12:34:56.78p."

After currDate and currTime are created, they are written to a file called LOGTRAIL.TXT for future reference.

To keep a low profile, this file has its hidden attribute set. The "IF EXIST..." line in BOOTTIME.BAT removes the hidden attribute from LOGTRAIL.TXT if BOOTTIME has been run previously. If LOGTRAIL.TXT does not yet exist, the "IF EXIST" part of the line keeps ATTRIB from printing an error message to the screen. A redirected echo command then appends the date and time data to LOGTRAIL.TXT and the file is again hidden. Next, BOOTTIME erases its environment variables from memory and its temporary files from disk, and then it ends.

After BOOTTIME.BAT was installed on my system, it pinpointed the time of intrusion on my PC to approximately 6:30 every other weekday. By staying at work late for a couple of days, I was able to observe a coworker copy data files from my PC after he thought I had left for the day. Needless to say, he was speechless when I confronted him with the exact dates and times when his "burglaries" had occurred!

Scott A. Sumner
Canton, Michigan

► **PC MAGAZINE:** It's a rare batch file that can catch a thief in the act! BOOTTIME.BAT uses the well-known technique of creating a file called CURRENT.BAT to get the current date and time from DOS. It then stores that information in a hidden file, so that every time the computer boots up, there's a record. BOOTTIME.BAT itself, however, remains visible, either as a file or as a chunk of code in AUTOEXEC.BAT. Let's try to hide this trap even more thoroughly.

Starting with DOS 5.0, the ATTRIB command can add and remove the hidden attribute for files and directories. If you're using an earlier DOS version, the PC Magazine utility ATTR.COM or a similar program will do the same job. Create the directory C:\HID and use ATTRIB or another utility to hide it. DOS will still let you use CD to change to the hidden directory and run programs from it, but C:\HID won't show up in any directory listings.

Figure 2 is a modified BOOTTIME.BAT that assumes this file resides in the C:\HID directory. It no longer needs to unhide and rehide the LOGTRAIL.TXT file, because that file also resides in the hidden directory. The only other changes are adding a line to make the C:\HID directory current at the start and switching back to C:\ at the end. Just change the reference in AUTOEXEC.BAT to \HID\BOOTTIME.BAT and you've improved security.

Still, if your thief is smart, the line in AUTOEXEC.BAT that CALLs BOOTTIME is a dead giveaway. DOS 6.0 has a new feature that lets you do an even better job of hiding BOOTTIME.BAT. The new /K switch for COMMAND.COM is a twist on the old /C switch. Both tell COMMAND.COM to run whatever command follows, but where /C tells COMMAND.COM to terminate after running the command, /K lets COMMAND.COM stay loaded. You can use the /K switch on the SHELL= line

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BOOTTIME.BAT

Complete Listing

```
@ECHO OFF
REM Records the date and time every time the PC
REM is (re)booted in the hidden file LOGTRAIL.TXT.

ECHO set currDate=%%3 %%4>CURRENT.BAT
ECHO.|date >CURRENT2.BAT
CALL CURRENT2

ECHO set currTime=%%3>CURRENT.BAT
ECHO.|time >CURRENT2.BAT
CALL CURRENT2

IF EXIST LOGTRAIL.TXT ATTRIB -h LOGTRAIL.TXT
ECHO %currDate% %currTime%>>LOGTRAIL.TXT
ATTRIB +h LOGTRAIL.TXT

FOR %%v IN (currDate currTime) DO SET %%v=
DEL CURRENT?.BAT
```



Figure 1: CALL this batch file from your AUTOEXEC.BAT to keep a hidden log that shows each time your PC is booted up.

in CONFIG.SYS to make COMMAND.COM load a batch file *other* than AUTOEXEC.BAT at start-up. Use a SHELL= line like this

```
SHELL=C:\DOS\COMMAND.COM C:\DOS\
/K C:\HID\BOOTTIME.BAT /P
```

Then add AUTOEXEC as the last line in BOOTTIME.BAT. Now when you boot up, BOOTTIME.BAT runs *before* AUTOEXEC.BAT. There's no evidence of your trap in AUTOEXEC itself!

You can download the batch files mentioned in this column from PC Mag-Net, archived as BOOTTL.ZIP.

Test New Drivers Safely

Every so often I need to test a new device driver. But if my machine locks up with the modified CONFIG.SYS file, just rebooting doesn't help. I have to go find my backup boot disk in order to get the machine working sufficiently so I can remove the offending device driver.

To avoid this problem, I now place the device driver in the B: drive of a computer that has two floppy disk drives. Then I install the device driver as

DEVICE=B:devname.sys

That way if the machine locks up I can simply remove the disk from the B: drive and reboot.

*Kenneth W. Aschheim
New York, New York*

► **PC MAGAZINE:** If you put a device driver in your CONFIG.SYS that locks up the machine, you've got trouble. It's not possible to boot from the hard disk with that CONFIG.SYS active, so there's no way to edit it in order to *remove* the offending device driver. Yes, you can dig up a boot disk and boot from drive A:, but if you do have a B: drive, testing unknown drivers on drive B: is definitely faster.

Many users find it necessary to boot with different AUTOEXEC.BAT and CONFIG.SYS pairs for various purposes. You can extend the drivers-on-B: technique to get multiple configurations without multiple AUTOEXEC/CONFIG pairs. Just write your CONFIG.SYS so that it loads all of the drivers that are needed in any of the configurations from drive B:. For example, have your CONFIG.SYS load HIMEM.SYS, EMM386.EXE, and QEMM386.SYS from drive B:. Now if you boot with a disk that contains HIMEM.SYS and EMM386.EXE in drive B:, you get DOS-style memory management. Use a disk that contains QEMM386.SYS and you're booting with QEMM memory management. Or leave the B: drive empty for neither type of memory management. This technique is limited, though. It won't help if you need to load the same driver with different parameters, or if you need to change CONFIG.SYS commands like FILES= and BUFFERS=.

If you're running DOS 6.0 and a new device driver locks up your system, don't panic! All you have to do is reboot and watch the screen. When the message "Starting MS-DOS..." appears on the screen, press F5 to skip loading CONFIG.SYS and AUTOEXEC.BAT entirely, or press F8 to choose to execute each line in CONFIG.SYS. This will always work unless you have a SWITCHES= line in CONFIG.SYS that includes the /N or /F switches—so don't put that line in your CONFIG.SYS! □

BOOTTIM2.BAT

Complete Listing

```
@ECHO OFF
REM Records the date and time every time the PC is (re)booted
REM in the file LOGTRAIL.TXT. Assumes it resides in the
REM hidden directory C:\HID.
REM To *really* hide this file, include this line in CONFIG.SYS:
REM SHELL=C:\DOS\COMMAND.COM C:\DOS\ /K C:\HID\BOOTTIME.BAT /P
REM ... and add "AUTOEXEC" as the last line of this file.

CD \HID
ECHO set currDate=%%3 %%4>CURRENT.BAT
ECHO.|date >CURRENT2.BAT
CALL CURRENT2

ECHO set currTime=%%3>CURRENT.BAT
ECHO.|time >CURRENT2.BAT
CALL CURRENT2

ECHO %currDate% %currTime%>>LOGTRAIL.TXT

FOR %%v IN (currDate currTime) DO SET %%v=
DEL CURRENT?.BAT

CD ..
```



Figure 2: This version of BOOTTIME.BAT resides, along with its data file, in a hidden subdirectory.

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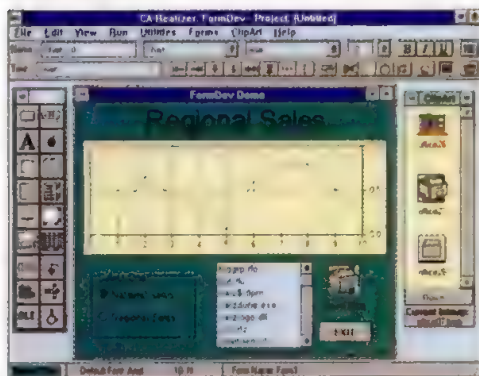
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Tutor

BY JEFF PROSISE

The WordBasic Programming Language

Microsoft Word for Windows is one of the most powerful word processors on the market. It's also one of the most flexible: The basic elements of its user interface—elements that are cast in stone and hidden deep within the bowels of most applications—can be modified to suit the needs of individual users. Want to add a new menu item to the Tools menu? No problem; just select Tools | Options | Menus and register the new menu item. Care to change a key assignment or add a new button to the overhead toolbar? That's no problem, either. In fact, WinWord puts so many configuration options before you, there's virtually no end to the remodeling and reshaping that you can do.

But perhaps the most remarkable aspect of WinWord is its built-in programming language, WordBasic. WordBasic is a powerful application-specific development tool modeled after the BASIC language, which is familiar to millions of PC users. It's an extensive programming platform that provides indirect access to the Windows application programming interface (API) functions and can even be used to effect Dynamic Data Exchange (DDE). It is also the stuff macros are made of. Every WinWord macro that you define is stored internally as one or more WordBasic statements. If you've never used WordBasic, you're missing out on one of Word for Windows' most potentially useful features.

Unfortunately, the *Using WordBasic* manual isn't included in the basic WinWord package but must be ordered separately. The WinWord *User's Guide* contains a scant 24 pages of information on WordBasic. As a result, the majority of WinWord users have never used WordBasic directly. A number of users probably aren't even aware that it exists. But it's there, and with it an enterprising user can customize WinWord to his heart's delight and even write dedicated mini-apps that exist only within the context of his word processor.

THE BASICS OF WORDBASIC If you're already familiar with modern (structured) dialects of the BASIC programming language, then you can easily pick up WordBasic. The syntax is very much the same. WordBasic supports most of the standard BASIC flow-control statements (Goto, For-Next, If-Then-Else, Select Case, and While-Wend), and it handles variables in exactly the same way as BASIC. The chief difference between BASIC and WordBasic is that the latter supports many statements and functions specific to WinWord. For example, the CenterPara command centers a paragraph on the page, and DocSplit splits the current document window into two panes. In all,

WordBasic supports about 500 different statements and functions. If you don't have access to a copy of *Using WordBasic*, you can list all the commands that WordBasic supports by selecting Help Index from WinWord's Help menu and clicking WordBasic Programming Language. Click on a command name to get syntactical help with that command, or click on WordBasic Cross Reference to display a list of WordBasic command categories. You can also get context-sensitive help inside the macro-editing window by pressing F1 while the cursor is positioned over a command.

WinWord stores all macros internally as WordBasic programs. There are two ways to create a macro, and therefore two ways to create a WordBasic program: by using WinWord's built-in macro recorder to record a series of mouse and keyboard events, or by opening a macro-editing window and directly entering the macro statements. To demonstrate the former technique, select Record Macro from WinWord's Tools menu, enter a macro name in the Record Macro Name box (or accept the default), and click OK. With WinWord now recording your every action, type "Hello, world" and select Stop Recorder from the Tools menu. Then select Tools | Macro, high-

light the macro name in the Macro Name list box, and click Edit. WinWord's macro-editing window will appear, displaying the following three program lines:

```
Sub MAIN
Insert "Hello, world"
End Sub
```

What happened? WinWord's macro recorder converted your keystrokes into a WordBasic command that says, "Insert the text 'Hello, world' into the document at the current cursor position." When you replay this macro, WinWord will execute the WordBasic program you just created. Alternatively, you could have created the macro directly by selecting

With WordBasic, an enterprising user can customize WinWord to his heart's delight and even write dedicated mini-apps.

Tools | Macro, entering the macro name in the Macro Name box, clicking Edit to display the macro-editing window, and typing Insert "Hello, world". You can create simple macros using the macro recorder, but to create complex macros (that can, for example, use conditional logic to branch to different instructions based on the value of a variable or the result of an input event) or macros that contain WordBasic commands for which there are no keyboard, menu, or toolbar equivalents, you'll need the macro editor.

The best way to get familiar with any programming language is to jump right in and start writing programs, and WordBasic is no exception. Limited space prohibits a full treatment of the WordBasic programming language, but to get you started (and perhaps to get you interested in learning more about WordBasic), the remainder of this column presents some useful WordBasic macros designed to solve common problems with WinWord. To enter these macros, open the macro-editing window as described above and enter the macro text as shown. To save a macro, close the macro-editing window by double-clicking the control-menu box in the window's upper-left corner and answer yes when WinWord asks if you want to keep the changes. Then when closing WinWord, answer yes when WinWord asks if you want to save global glossary and command changes. Another way of saving the macro is to select Save All from WinWord's File menu and answer yes when WinWord asks you about saving your changes.

WORDBASIC AND THE AUTO MACROS WinWord reserves a handful of macro names for special purposes. For example, if a macro is named AutoExec, that macro is automatically executed whenever WinWord is started. Similarly, the AutoOpen macro is executed every time a document is opened. Other Auto macros include AutoNew, which is executed when a new document is created; AutoClose, which is executed when a document is closed; and AutoExit, which is executed when WinWord terminates. Combined with a few simple WordBasic instructions, the Auto macros present some special opportunities for you to customize WinWord's behavior.

Here's an example. By default, Win-

Word positions the cursor at the beginning of a document when an existing document file is opened. You can return the cursor to the position it was in when the document was last saved by pressing Shift-F5, which invokes WordBasic's GoBack command. If you'd prefer that WinWord return the cursor to its previous position by default, create the macro

```
Sub Main
GoBack
End Sub
```

Be sure to name the macro AutoOpen, and save it as a global macro. Then each time you open a document, WinWord will restore the cursor to its last position. The only problem with this macro, as Guy

.....

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.....

Gallo points out in his excellent book *Take WinWord to the Edge* (1993, Ziff-Davis Press), is that it has the odd effect of switching back to the previously active document when you open a template, rather than a document, for editing. You can easily solve this problem by modifying the macro to read

```
Sub Main
If ExistingBookmark("\PrevSel1").
Then EditGoTo "\PrevSel1"
End Sub
```

When a document is saved, WinWord automatically stores the cursor position as a bookmark called \PrevSel1. AutoOpen will return to the previous insertion point only if this bookmark exists in the current file, a condition that does not hold true for templates.

One use for the AutoExec macro is to make sure that WinWord's main program window pops up in a certain state. If you terminate WinWord while it is maximized, it will automatically maximize the next time you start it. If you terminate WinWord in a windowed (non-maximized) state, it will restart in a windowed state. You can ensure that WinWord will always maximize itself on start-up by creating the following macro and naming it AutoExec:

```
Sub Main
If Not AppMaximize()
Then AppMaximize
End Sub
```

The AppMaximize command doubles as both a statement and a function. AppMaximize() returns a nonzero value if the WinWord window is maximized. AppMaximize (without the parentheses) maximizes the window if it's not maximized or restores it to nonmaximized form if it is already maximized.

The tasks that you can accomplish with WordBasic and the Auto macros are limited only by your imagination. You could, for example, write AutoExec and AutoExit macros that use WordBasic's Date\$() and Time\$() functions to write a date and time entry to a log file each time WinWord is started or terminated, or each time a document file is opened or closed.

Like any good programming language, WordBasic supports a full complement of file I/O functions. You could even write an AutoExec macro that prompts the user for a user name or a password to restrict access to WinWord. Lest you rely too heavily on Auto macros for security, however, be aware that starting WinWord with a /M switch bypasses AutoExec.

TRANSPOSING CHARACTERS If you're like me, when you scan your word processing documents you frequently find that in your haste you accidentally reversed two characters in the middle of a word. The word *transpose*, for instance, may become *trasnpose*. This little problem can be easily corrected by this macro, which exchanges the character left of the cursor with the character right of the cursor:



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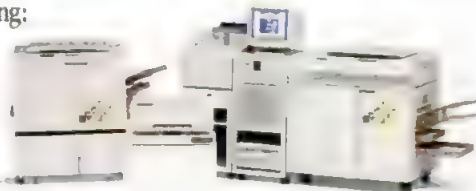
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```

Sub Main
CharLeft 1,1
EditCut
CharRight
EditPaste
CharLeft
End Sub

```

Before running this macro, position the cursor between the two characters that you wish to transpose. If you use this macro often, you can use the Keyboard section of WinWord's Tools | Options menu to assign the macro to a key combination, menu, or toolbar button. Then you can run it without having to bring up WinWord's Macro dialog box.

SPLIT WINWORD'S WINDOW VERTICALLY If you use the Borland C for Windows program editor (part of the Borland C++ package for DOS and Windows), you, like me, may have grown to love its Window | Tile command. When invoked with two source-code files open, Window | Tile splits the document window vertically in half and fills each half with a source-code window. This is a wonderful arrangement for comparing two source-code files line for line. WinWord has no comparable command, though you can split the document window horizontally with Window | Arrange All.

With WordBasic, you can arrange document windows however you like. The following macro tiles two documents vertically so that each fills the entire screen from top to bottom, but only half of the screen horizontally:

```

Sub Main
If CountWindows() = 2 Then
  xPos = Val(AppInfo$(6)) / 2
  yPos = Val(AppInfo$(7))
  If DocMaximize()
    Then DocMaximize
  DocMove 0, 0
  DocSize xPos, yPos
  NextWindow
  DocMove xPos, 0
  DocSize xPos, yPos
  NextWindow
Else
  Beep
  MsgBox "There must be exactly
  two documents open", "Error", 48
End If
End Sub

```

The macro only tiles the windows if CountWindows() returns the value 2, meaning there are exactly two documents open. The active document is placed on the left, the inactive one on the right. If more or fewer than two documents are open, the MsgBox statement displays an error message. This macro calls DocMaximize to nonmaximize the active document window if it is currently maximized, because neither DocMove nor DocSize will work on a maximized window. AppInfo\$(6) and AppInfo\$(7) return the width and height of the active document workspace, respectively.

.....

With the Options dialog box, WinWord lets you assign macros and WordBasic commands to key combinations.

.....

CHANGING DEFAULT KEY ASSIGNMENTS

Through the Options dialog box invoked with the Tools | Options command, WinWord lets you assign macros and WordBasic commands to individual keys and key combinations. This makes it possible to change the default actions initiated by the A to Z, 0 to 9, F2 to F12, Ins, and Del keys—alone or in combination with the Ctrl or Ctrl and Shift keys. With this remapping capability and a helping hand from WordBasic, you can add some interesting twists to WinWord's keyboard interface. For example, the following macro, when assigned to the Ins key, causes WinWord to emit a beep whenever you press the Ins key to switch between insert and overstrike modes (a handy feature if you hit Ins by accident and don't realize you're in overstrike mode until you've overtyped a line of text):

```

Sub Main
Beep
Overtyp
End Sub

```

WinWord's Options dialog box offers

only a limited selection of keys, but you can reprogram virtually any key on the keyboard using WordBasic's ToolsOptionsKeyboard command. The following WordBasic macro programs the Alt-Spacebar key combination to execute a macro named DoCalc. (Alt-Spacebar normally displays the system menu.)

```

Sub Main
ToolsOptionsKeyboard .Name="DoCalc",
  .KeyCode=1056, .Context=0
Print "Alt-Spacebar is now enabled"
End Sub

```

The value 1056 for the .KeyCode value is derived from a table in the Help for the ToolsOptionsKeyboard command. DoCalc, in turn, is defined

```

Declare Function IsAppLoaded
  Lib "Kernel" (Name$) \
As Integer Alias "GetModuleHandle"

```

```

Sub MAIN
If IsAppLoaded("Calc") Then
  AppActivate "Calculator"
Else
  Shell "CALC.EXE", 1
End If
End Sub

```

After the first of these macros is executed, pressing Alt-Spacebar executes DoCalc, which brings up the Windows Calc accessory. If Calc isn't already loaded somewhere in the system, DoCalc launches Calc with a Shell command. If Calc is already loaded, DoCalc simply brings Calc to the foreground by calling AppActivate and passing it Calc's window title. Among other things, DoCalc illustrates how WordBasic programs can directly access Windows API functions. In this case, IsAppLoaded invokes Windows' native GetModuleHandle function, which accepts a module (program) name and returns a module handle if a module of that name is active in the system. A return value of 0 means the module is not loaded.

One of the most inventive uses for WordBasic key remapping that I've ever seen is embodied in the SmartQuotes macro supplied with WinWord (in the document file NEWMACRO.DOC).

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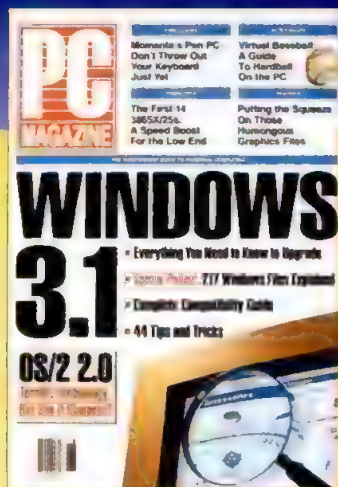


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PC TECH

Tutor

SmartQuotes is actually four macros in one. AutoEnableSmartQuotes reprograms the keyboard to execute AutoInsertSingleQuote when the Apostrophe key is pressed and AutoInsertDoubleQuote when the Shift and Apostrophe keys are pressed together. These AutoInsertQuote macros replace the standard typewriter-style single and double quotation marks with publisher-style curled quotation marks as you type. The fourth macro, AutoDisableSmartQuotes, restores normal operation.

WRAPPING UP To close, here's a favorite WordBasic macro of mine that inserts today's date into a WinWord document:

```
Sub Main
InsertDateTime .DateTimePic
= "MMMM d, yyyy"
CharLeft
UnlinkFields
CharRight
End Sub
```

Of course, inserting a date using WinWord's Insert | Date and Time command is easy enough. But dates inserted with Insert | Date and Time are inserted as fields, which is inappropriate if all you need is, say, a date at the top of a business letter. This macro inserts a field containing today's date in the format August 23, 1993, and then converts the field into static text. Now you don't have to worry about the date at the top of the letter changing if you decide to update other fields in the document.

Needless to say, this discussion only scratches the surface of what you can do with WordBasic. If you would like more information, you can order *Using WordBasic* from Microsoft. You'll find instructions for ordering in your WinWord package. As an alternative, you can call Microsoft Sales and Service at 800-426-9400. You may also find it helpful to pick up a good book on the subject. Two of my favorites are *Take WinWord to the Edge* (1993, Ziff-Davis Press) and Woody Leonhard and Vincent Chen's *Hacker's Guide to WinWord* (1993, Addison-Wesley Publishing Company).

Take some time to explore WordBasic, and you'll open up a whole new universe of possibilities for customizing the WinWord environment. □



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Windows Magazine, January 1993

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Lab Notes

BY MARK L. VAN NAME AND BILL CATCHINGS

Understanding PC Labs' New Benchmark Tests

With the hardware reviews in this issue, PC Magazine Labs introduces three new benchmarks for measuring desktop PC performance. Two are major new versions of old friends: WinBench 4.0 and PC Bench 8.0. The other, Winstone 94, Version 1.0, is a new addition to PC Magazine Labs' benchmark test arsenal.

These three benchmarks represent the culmination of a year of research and development by PC Magazine Labs and the Ziff-Davis Benchmark Operation (ZDBOp), the research and development division of Ziff-Davis charged with creating benchmark tests. As a team, they give *PC Magazine* an unparalleled ability to predict and analyze PC performance.

PC Bench 8.0 supplies a wealth of detailed information about DOS-based PCs and produces an overall measure of their performance. WinBench 4.0 provides detailed information about a PC's graphics and disk performance under Windows. And Winstone 94 is PC Magazine Labs' first publicly available, application-based benchmark test. It uses scripts that exercise real applications to give an overall measure of a PC's performance under Windows 3.1.

KEY CONCEPTS Each of these benchmark tests focuses on a different aspect of desktop PC performance measurement, but a few key concepts are at the heart of all of them. All three types of tests, for example, are "market-centered"—that is, they reflect the way typi-

cal users (the center of the PC market) use their PCs. Rather than aiming for particular groups of specialized users, such as architects who spend all day in CAD programs or graphics designers who live and breathe page-layout software, these tests target typical users doing tasks with common, off-the-shelf applications.

The applications used in Winstone 94, for example, are part of that test precisely because they are top-selling Windows applications. In addition, each application's proportion of the overall Winstone score reflects that application's share of the Windows software market. Both WinBench and PC Bench are also market-centered, but that's harder to see because they are synthetic benchmarks: Instead of running actual applications, they contain specially written tests that behave the way applications behave.

Before you can emulate application behavior, you first have to know what the applications are doing. Enter the technology called *profiling*. Profiling has been an important element of our benchmark test development process for years, and this year we have taken our profiling research to new levels. Using a variety of profiling tools both commercially available and

developed in-house, we have monitored and logged the way many different applications work with PCs while performing typical tasks. The results of these profiling efforts determine how the tests in the WinBench and PC Bench suites work. Each of the key tests in these benchmark series is designed to reflect the statistical profiles of a set of target applications.

WinBench's Graphics WinMark score, for example, reflects the extensive profiling of the applications in Winstone 94. All the Windows graphics calls that figure into that score are also used in the Winstone applications. Changes in the way desktop PCs and applications work have also greatly affected our new PC benchmark tests. Nothing else in this industry stands still, so neither should our test suites.

As PCs become complex, it is less important to measure the performance of individual pieces of hardware accurately. Sure, the access time of a hard disk is an important part of disk performance, but

in these days of caching disk controllers and software disk caches, access time alone is not the whole story. Instead, good disk tests must look at the entire disk subsystem, including both hardware and software. It's not enough to look at just the drive; you must also consider the drive controller and any hardware or software disk caches.

Other subsystems have also grown more complicated with each passing year. To examine graphics performance under Windows, for example, you must include not only the video adapter but also its driver. The raw speed of a CPU on its own means almost nothing until you take into account its level-one (L1) and level-two (L2) caches, the system RAM, and the speed of the bus that connects the CPU to system RAM. The only way that a benchmark test can accurately measure how an application uses a PC subsystem is to treat it the way the application does: as a subsystem.

As a group, PC Bench 8.0, WinBench 4.0, and Winstone 94, Version 1.0 give PC Magazine an unparalleled ability to predict and analyze PC performance.

THE WINSTONE 94 BENCHMARK TEST

Business graphics:	Corel Systems' CorelDRAW!, Version 4.0 Microsoft PowerPoint, Version 3.0
Database:	Borland International's Paradox for Windows, Version 1.0 Claris Corp.'s FileMaker Pro, Version 2.0v1 Microsoft Access for Windows, Version 1.10
Desktop publishing:	Aldus PageMaker for Windows, Version 5.0
Multifunction:	Microsoft Works, Version 2.0a
Spreadsheet:	Borland International's Quattro Pro for Windows, Version 1.0 Lotus Development Corp.'s 1-2-3, Release 4 for Windows Microsoft Excel for Windows, Version 4.0
Word processing:	Microsoft Word for Windows, Version 2.0c WordPerfect Corp.'s WordPerfect for Windows, Version 5.2

Figure 1: The Winstone scores are determined by running 12 applications in six categories. Each product's market share is factored into the weighting of tasks in the final Winstone score.

THE NEW TESTS... Each of the three new tests brings a different and complementary set of features to the table. PC Bench covers the still-huge DOS part of the PC world. It provides subsystem test suites as well as the DOSmark score, an overall measure of PC performance under DOS.

WinBench supplies the graphics and disk parts of that puzzle. While it does not produce an overall system score, WinBench contains graphics and disk

all the technical improvements in these new benchmark tests, the first thing you'll notice when you run them is their new user interfaces. We've listened to your comments and responded: The new tests are easier to use than ever. For the first time, all three tests now share a common basic interface design. We designed all of them to make it easy for you to get results of key performance tests quickly and easily.

Buttons run down the left side of the

tests that let you focus on the performance of these subsystems. That data helps us see the factors behind a PC's Windows performance. Winstone 94 measures the overall performance of an entire PC running best-selling applications under Windows 3.1. Its score is a good gauge of the performance you can expect when doing typical tasks with common applications. On its own, however, a Winstone score doesn't provide any data about the factors contributing to that level of performance.

...AND THEIR NEW COMMON FACES

Despite

screen on all three benchmark test suites; just click on the Run button to launch the key tests. On PC Bench, that simple act will get you the DOSmark. On WinBench, it will get the Graphics WinMark and Disk WinMark, and on Winstone, the overall score. When the testing is complete, graphs that illustrate your PC's performance appear. Add some comparison systems by clicking on the Compare Results button and you'll get graphical feedback on how your PC performed.

Other buttons and a set of simple menus let you run individual tests, manipulate graphs, save results, and get detailed information about your PC. Equally important, all three benchmark test suites now include extensive on-line help and complete manuals. Each manual is available on the appropriate test disk at least in Word for Windows and ASCII formats, and you can also order perfect-bound printed manuals for a nominal fee (see the sidebar "How to Get the New Benchmark Tests").

Finally, given the huge volume of products PC Magazine Labs tests every issue, we have gone to great lengths to make sure that the benchmarks support customized testing. If you need to test multiple machines, you can create powerful test suites that contain a definition of the exact tests you want to run. By copying the test suite definition file to multiple machines, you can make large-scale test-

How to Get the New Benchmark Tests

To obtain copies of PC Bench 8.0, WinBench 4.0, or Winstone 94, Version 1.0, for your own use, you can download them from ZiffNet. All three benchmark tests suites are available in the PC Labs Library of PCMagNet's Utilities/Tips Forum (GO ZNT:TIPS). All related files can be found using the search word BENCHMARKS.

To make it easier for you to get benchmark test support, the Ziff-Davis Benchmark Operation will have its own ZiffNet forum (GO ZDBENCH) starting November 16, 1993. This forum will offer the latest versions of all Ziff-Davis benchmark tests as well as updates, helpful hints, bug reports, and

general debates.

If you'd like copies of one or more of the benchmark tests but don't have a modem, you can request those copies by sending a postcard to the following address:

Ziff-Davis Benchmark Operation
One Copley Parkway, #510
Morrisville, NC 27560
Attn.: Distribution Coordinator

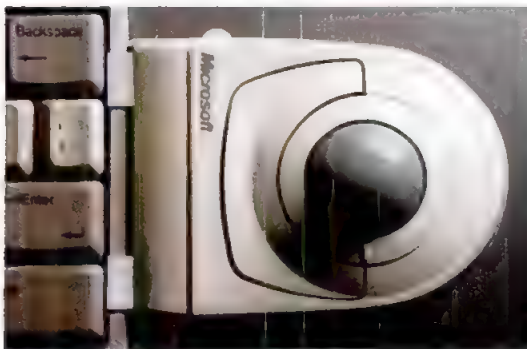
You can also fax your request to 919-380-2879.

With all requests, please include your name, address, phone number, and the names of the benchmark tests you want. Please allow four to six weeks for delivery. If you'd like faster

delivery, enclose your Federal Express account number and Federal Express shipping instructions. Please note that Winstone 94 comes on a CD-ROM, so it is useful only if you have access to a CD-ROM drive. The Winstone CD-ROM includes copies of PC Bench and WinBench, so if you ask for Winstone 94, you'll automatically get all three benchmark test suites. PC Bench and WinBench are each available on 3.5-inch floppy disks.

Each benchmark test comes with an on-line copy of its manual. Offset-printed, bound copies of each manual are also available for \$10.00 each, which includes postage.

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YOUR BOSS,
YOUR WORKLOAD,
YOUR WEIGHT,
YOUR BACKHAND,
YOUR WEEDS,
YOUR DOG, YOUR LIFE.
AT LEAST NOW
YOU CAN CONTROL
YOUR CURSOR.**



At Microsoft, we feel there are enough things in the world that follow their own unpredictable path.

So we redesigned just about every aspect of the new Microsoft® BallPoint® mouse to let you regain control of your portable computer.

We started by changing the weight of the ball. We improved the smoothness of the tracking mechanism. We reshaped our mouse to fit your hand better. We even added software features that make it easier to find and control your cursor.

All of which means, in simple terms, that the cursor will now do what you want it to do.

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Of course, you should try it yourself. So pick up a BallPoint mouse at a computer store today.

And have one aspect of your life firmly, and comfortably, in the palm of your hand.

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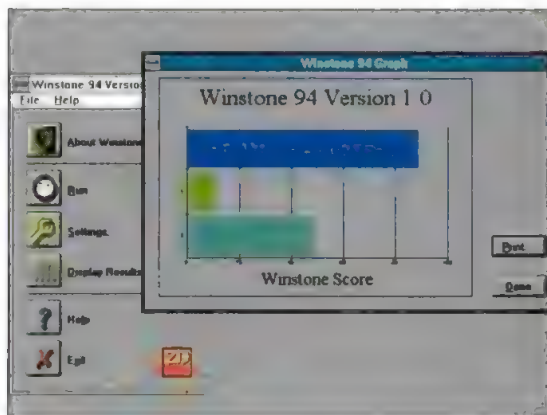


Figure 2: Winstone scores are based on the time required to execute a set of application scripts that exercise 12 of the best-selling Windows 3.1 applications. Winstone 94 uses the individual script execution times and the unit market shares of the applications to compute each score. Winstone 94 normalizes that score against a reference machine whose score is 10.0. Bigger scores are better; a PC with a score of 20.0, for example, will deliver twice the performance of the reference machine when running typical Windows 3.1 applications.

ing of computers from the command line a reality.

RULES OF THE GAME New tools usually bring new rules, and these tests are no exception. To get the most from them, you need to follow a few basic guidelines. The most important point to understand is that the results of these tests are in no way comparable with the results of previous versions. Period. There's no secret formula, no magic transformation that can turn a WinBench 3.11 result into a WinBench 4.0 score. WinBench 4.0 and PC Bench 8.0 represent significant enhancements over their previous versions, and their results are just not comparable with those of the earlier versions.

We haven't made this change lightly. We know you may have invested a lot of time in learning how to use and interpret the results of previous versions and, frankly, so have we. But as time and technology march on, we must keep up. Once a year we take this opportunity to overhaul the way our tests work so that they can reflect the current state of both system technology and the way applications use that technology. To help you place the results of these new versions in context, this issue of *PC Magazine* contains reviews of a large number of systems and video adapters.

In those reviews, note that we have

provided a great deal of configuration information about the PCs and cards tested. Such information is vital in any attempt to understand benchmark test results, because without a context the results are practically meaningless. We encourage you to do the same thing when you discuss or publish benchmark test results. (In fact, if you're planning to publish any test results we actually require it: All three benchmarks have licensing agreements that specify the information you must supply when you publish the results of these tests.)

To get scores worth publishing, we follow strict test methodologies. If you want to get the most value and reproducibility from these tests, we en-

courage you to do the same. Factors that are not always obvious can affect the way PCs perform. A heavily fragmented disk, for example, will usually run far slower than one with electronic acres of open, contiguous space. Consequently, you should defragment your disk between runs of any benchmark test to get the most accurate and repeatable results. Also, you should always reboot between test runs and make starting the benchmark test the first thing you do.

It's also important to make comparisons that make sense. Comparing systems tested in different ways can be dangerous. Test one PC's disk performance with SMARTDRV active and another with no software disk cache, and you won't learn much about the relative speeds of the two disk subsystems. On the other hand, it's fine to test the disk performance of a single PC with and without SMARTDRV or any other disk cache because that's a good way to assess just how much of a performance boost SMARTDRV is likely to deliver on that system.

Finally, we must note that every time we release new

benchmark tests, we give the industry new, tougher targets to hit. When our benchmark tests appear, vendors often scramble to optimize their products to produce better scores on our tests. Because our profiling research has made our tests reflect the way applications use PCs, improvements in the test scores generally correspond to improvement in real-world application performance. Thus, the vendor scramble is good for all of us because we all get to choose from ever-faster products.

WINSTONE 94, VERSION 1.0 Winstone 94, Version 1.0, is Ziff-Davis's first publicly available, application-based, system-level benchmark test. PC Magazine Labs, ZDBoP, and Microsoft have worked together to bring this benchmark test to fruition. Winstone 94, Version 1.0, represents the sole Microsoft-certified routine for testing PCs running Windows 3.1-based applications. The big news about Winstone 94 is that it's big: It comes on a CD-ROM with real applications, not demo versions. The applications aren't complete because Winstone 94 contains only the files it needs to perform its tests, but every application file on it is the real thing. (Note that doing anything with these application files except letting Winstone 94 use them for testing PCs is expressly against the Winstone 94 License Agreement.)

Twelve Windows 3.1 applications in six categories make up the Winstone test (see Figure 1). We chose these applica-

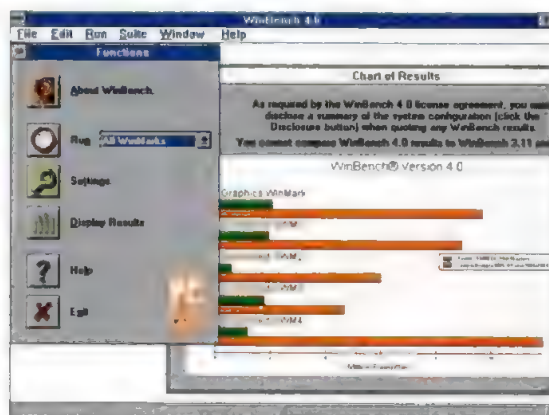


Figure 3: WinBench uses 66 different tests of Windows GDI functions to produce the Graphics WinMark score, a measure of PC graphics performance under Windows 3.1. These tests, which are based on extensive application profiling, run in seven graphics test mixes that WinBench weights and combines to produce the Graphics WinMark score, expressed in millions of pixels a second.

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WHAT YOU
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FROM
OFFICE PRINTERS.

Speed ('spēd) *n.* 1. A feature rarely found in low-cost inkjet printers. *example:* In letter quality mode, the **TI microMarc™** printer gives you laser quality printing at twice the speed of the HP DeskJet™ printer.

This sample printed on a Texas Instruments microMarc printer



THE UNDER \$300 PRINTER, REDEFINED.

If you're looking for a printer with a street price under \$300*, you no longer have to settle for poor print quality or painfully slow print speed.

Now, for about the same price as a dot matrix printer, the TI microMarc, with its advanced inkjet technology, will give you the same 300 dpi print quality as most laser printers.

And unlike our biggest competitor, the HP DeskJet, instead of 50 nozzles applying ink to the page, we give you 128 nozzles. Which means that, in letter quality mode, we print text twice as fast. We also give you more memory than they do, for improved graphics. And the benefits don't stop there.

The TI microMarc is also easy to use, thanks to its new high-capacity, easy to replace ink cartridge.

The TI microMarc. It's so quiet, so reliable, so inexpensive to run and easy to use, it can help you get more from your printer than you ever thought possible. At a price you probably never thought possible. For more information or a dealer near you, call **1-800-527-3500**.

	TI microMarc	HP DeskJet 500
<i>Speed (in letter quality mode)</i>	300cps	120cps
<i># Of Nozzles</i>	128	50
<i>Print Quality</i>	300 dpi	300 dpi
<i>Memory</i>	24K	16K
<i>Pages/Cartridge</i>	1400	1000
<i>Weight</i>	12.1 lbs.	14.9 lbs.

Specifications in chart are based on information as of 9/93. *Estimated dealer price. Dealer prices will vary. microMarc, microWriter and "Extending Your Reach With Innovation" are trademarks of Texas Instruments. DeskJet is a trademark of Hewlett-Packard, Inc. Adobe, PostScript and the PostScript logo are registered trademarks of Adobe Systems, Inc. © 1993 TI

Flexibility (flek·sə·bil·ə·tē) *n.* 1. A feature previously not found in this category. *example:* For under \$800, **TI microWriter™** printers give you the *flexibility* to start with **Adobe® PostScript®** or add it later; the comparable HP 4L does not.



THE UNDER \$800 PRINTER, REDEFINED.

If you're looking for a printer with a street price well under \$800, you'll have a hard time finding one with as many features as a TI microWriter.

Let's compare it to our leading competitor, HP, starting with basic models. First, take flexibility. Ours lets you add PostScript now or later. With the HP 4L you can't add it at all. Take paper handling. Ours comes with a 250-sheet tray standard, theirs with just a 100-sheet. Speed? We give you 5 ppm, they give you 4. Yet in spite of all this, we still list for hundreds of dollars less.

Now, let's compare high end models. As you'll see from the

chart, the features here are basically comparable—till you get to price. And once again, the TI microWriter is clearly the better value. For more information or a dealer near you, call 1-800-527-3500.

	TI microWriter Basic	HP 4L	TI microWriter PS23	HP 4ML
<i>Print Speed</i>	5 ppm	4 ppm	5 ppm	4 ppm
<i>PostScript</i>	Upgradeable	No	Standard	Standard
<i>Paper Trays</i>	(std.) 250 sheet	100 sheet	250 sheet	100 sheet
	(opt.) 250 sheet	Not Avail.	250 sheet	Not Avail.
<i>List Price</i>	\$599	\$849	\$799	\$1279

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Compatibility (kəmˌpat.əˈbil.ət.ē) *n.* 1. A feature typically lacking in this category. *example:* The new **600 dpi TI microLaser™ Pro 600** printer gives you DOS, Windows, Mac, PCL5 and PostScript® compatibility standard; HP charges hundreds more.



Adobe PostScript

Specifications in chart are based on information as of 9/93. *Estimated dealer price including manufacturer's rebate is under \$1400. Dealer prices may vary. †At 4% coverage. ‡Rebate applies to PS33 model. microLaser and "Extending Your Reach With Innovation" are trademarks of Texas Instruments. Adobe, PostScript and the PostScript logo are registered trademarks of Adobe Systems, Inc. LaserJet is a registered trademark of Hewlett-Packard, Inc. Mac is a registered trademark of Apple Computer, Inc. © 1993 TI

THE UNDER \$1400 PRINTER, REDEFINED.

Ask
About Our \$60
Introductory
Rebate.*

If you're looking for a true 600 dpi printer with a street price under \$1400, you'll have a tough time beating the new TI microLaser Pro 600.

You see, when we set out to design the ideal office printer, we began by asking thousands of users what they wanted most. And then, instead of making those "key care-about's" optional, as others do, we made them standard.

Take print quality. We began with true 600 dpi resolution. And then enhanced it with 6MB of memory for improved graphics. Compatibility? We're DOS, Windows and Mac compatible right out of the box. With all the right languages and interfaces. And with the intelligence to switch these automatically, depending on the environment. Low maintenance? Our new toner cartridge typically gives you 15,000 pages between changes.

Paper handling? Two 250-sheet trays come standard. And finally, value. As the chart below shows, not only do we give you a lot more than our leading competitor, we also charge you a lot less.

So if you're considering a new printer, we invite you to try the new TI microLaser Pro 600. For more information or a dealer near you, call **1-800-527-3500**.

	TI microLaser Pro 600	HP LaserJet* 4	HP LaserJet 4M
<i>True 600 dpi</i>	Yes	Yes	Yes
<i>Speed/Processor</i>	8 ppm/RISC	8 ppm/RISC	8 ppm/RISC
<i>Memory</i>	6MB	2MB	6MB
<i>Emulations</i>	PCL5/ Adobe® PostScript 2	PCL5E	PCL5E/ Adobe PostScript 2
<i>Compatibility</i>	DOS/Mac	DOS	DOS/Mac
<i>Toner Cart. Life</i>	15K pages*	6K pages	6K pages
<i>Paper Trays</i>	250 sheet/ 250 sheet	250 sheet/ 100 sheet	250 sheet/ 100 sheet
<i>Auto Language Switching</i>	Yes	No	Yes
<i>Auto Interface Switching</i>	Yes	Yes	Yes
<i>List Price</i>	\$1599*	\$1759	\$2399

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tions because of their high current and projected 1994 unit market share. To get the market-share data, we turned to Info-Corp, a leading market-research firm. The unit market share information not only determined the applications we put into Winstone 94, it also determined the weight each one had on the overall Winstone score. Winstone 94 uses Microsoft Test 2.0 for Windows scripts to put the applications through their paces. Like everything else in Winstone 94, those scripts mirror what typical users do with those applications. Surveys taken by PC Labs and information input from Microsoft's Usability Lab, in conjunction with ZDBOp research, defined the kinds of activities each script performs.

Winstone 94 is a big test; in fact, you'd need a pretty large stack of floppy disks to hold it. Rather than making you heft a stack of disks, we distribute Winstone 94 on a CD-ROM. You can run it directly from that CD-ROM, install it on a local hard disk, or install it on and run it from a network server. No matter how you run it, our tests show that it produces essentially the same results.

The basic way Winstone 94 works is fairly simple. When you click its Run button, it executes each of its 12 application scripts in turn and then computes the score (Figure 2). To execute an application script, it copies that script and the necessary application files to a work directory. (That directory should be on the drive whose performance you want to assess; usually, that means the local hard disk of the PC you're testing.) Winstone 94 then starts its timer, runs the script, turns off the timer, makes an internal note of the elapsed time, and cleans out the work directory. Winstone 94 saves elapsed times for all 12 application scripts internally and uses them to compute the final score. Computing the score is fairly time-consuming, so be patient.

First, Winstone 94 normalizes each elapsed time relative to the time that a reference machine—a Compaq Deskpro 386/25M with 4MB of RAM—took to run the same script. It then weights each application's normalized result by that application's share of its software category to produce a category score. Next, it weights the category scores by their unit shares of the overall Windows 3.1 soft-

ware market. It uses a weighted geometric mean to combine all the category scores into a single overall system score. (Fortunately, this entire process is invisible; all you have to do is view the overall score.) Winstone 94 also sets the score for the reference machine to 10.0; higher scores indicate better performance.

A score of 20.0, for example, indicates a PC with twice the overall Windows performance of the reference machine. When you use Winstone 94 to analyze system performance, remember that its score is a system-level result. Different subsystems have different effects on that score, and no single subsystem determines the whole score. The fastest graph-

.....

*Our runs of
Winstone 94 have shown
that you can get big
performance gains on fast
systems by increasing the
amount of RAM.*

.....

ics adapter in the world, for example, won't help your Winstone score much if some other part of the system—disk, RAM, or CPU—is the real bottleneck.

Notice the presence of RAM on that list. Conventional wisdom has long held that sufficient RAM is a key element of good Windows performance, and Winstone 94 drives this point home. The reason is that Winstone 94 requires at least 4MB of RAM, and 3MB of that RAM must be free extended memory. That requirement obviously doesn't leave much room for SMARTDRV or other memory-resident programs, so more RAM is necessary to take full advantage of such potential performance boosters.

Our runs of the Winstone test have shown that you can get big performance gains on fast systems by increasing the amount of RAM. In one case, we saw a 66-MHz 486 with 4MB of RAM produce a Winstone score of only 15.8, just a little more than 50 percent faster than the speed of the reference machine.

Increasing the RAM on that 486/66 to 8MB, however, shot its score to 41.2; with 12MB of RAM the system turned in a Winstone score of 47.7. (Additional RAM beyond 12MB yielded improvements of less than 2 percent.) Clearly, for best results RAM is crucial.

Winstone 94 also needs a fair amount of disk space, although the bulk of that space—for the Winstone base directory—can be on the CD-ROM or on a server. The disk of the PC you want to test needs 25MB of free space for Winstone 94's working directory, and at least 5MB more free space if you're using a temporary Windows swap file. If you want to install the whole Winstone base directory on that disk as well, you'll need another 105MB of free space.

WINBENCH 4.0 WinBench 4.0, like its predecessor, Winbench 3.11, is a synthetic, subsystem-level benchmark test suite that can measure a PC's graphics and disk performance. WinBench 4.0, however, is a complete rewrite of Winbench 3.11. The heart of WinBench 4.0 is the huge volume of application-profiling data we gathered and used to design its tests.

To the degree possible with the profiling tools currently available, WinBench 4.0 measures graphics and disk performance by stressing those subsystems in the same ways as the applications that use them do. WinBench provides two main measures of subsystem performance: the Graphics and Disk WinMarks. The Graphics WinMark and Disk WinMark tests use profile-based synthetic workloads to measure the performance of their respective subsystems.

The profiling data underlying the Graphics WinMark tests is the most extensive video profiling we've yet done. To build the Graphics WinMark tests we profiled Winstone 94, in the process collecting about a gigabyte of raw data. The Windows graphics calls that the Graphics WinMark tests use are the same ones the Winstone applications use. Even the weights that WinBench places on those calls reflect Winstone 94: The same unit market-share data that play a key role in Winstone 94's score calculation determine the weights used in the context of the Graphics WinMark score (Figure 3).

Like Winstone 94, WinBench 4.0's

Satisfaction (sat.əs.'fak.shən) *n.* 1. A feature previously left to chance in the purchase of a printer. *example:* When you buy a new TI printer*, your **satisfaction** is **guaranteed** or call TI within 30 days and we'll take it back.



TEXAS INSTRUMENTS



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PRINTER,
REDEFINED.**

In the past year, we've introduced a whole new line of office printers. And as you've seen in the previous pages, they're some of the most advanced models on the market today. But now, we're also going to change the way you buy a printer.

When you buy one of these new TI printers, if you need any help at all, simply call us toll-free at 1-800-TI-TEXAS, and we'll work with you. Then, within 30 days from date of purchase, if you're still not completely happy, call TI and we'll take it back. It's as easy as that. That's how confident we are in each

and every printer we make. And even after the 30 days, you can continue to call the 800 number for any help you may need.

For more information about the TI microMarc™, the TI microWriter™ or the new TI microLaser™ Pro 600 printers, and for the name of a dealer near you, call 1-800-527-3500. And see for yourself how TI is redefining what you should expect from an office printer.

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* Offer applies to all new TI microMarc, microWriter and microLaser Pro 600 printers, if returned in good condition. microMarc, microWriter, microLaser and "Extending Your Reach With Innovation" are trademarks of Texas Instruments. © 1993 TI

CIRCLE 353 ON READER SERVICE CARD

graphics tests are also "distribution-based." The distribution of images and objects the tests display to gauge graphics performance is a statistical approximation of the distribution of the types of images and objects the Winstone applications display. Thus, rather than drawing many lines of the same size, WinBench 4.0 now draws a distribution of lines with average, minimum, and maximum sizes determined by profiling. Just watch the Graphics WinMark tests execute for a few minutes and you'll get a quick idea of how different WinBench 4.0 is from its predecessors.

The Graphics WinMark tests are also mixes of different operations rather than a sequence of single-operation tests. A total of 66 different tests of Windows graphics functions make up the Graphics WinMark suite. WinBench 4.0 groups those 66 different tests into seven graphics mixes, each of which mixes together a subset of those functions so that the same graphics function doesn't repeat over and over. Each operation's Winstone-based weight determines its frequency in the Graphics WinMark mixes. WinBench times the execution of each mix, uses a weighted harmonic mean to combine the results, and produces a Graphics WinMark score that indicates how many millions of pixels per second the tested PC can display.

As we have noted before, the Graphics WinMark scores from WinBench 4.0 are not comparable with the Graphics WinMark scores of previous versions of WinBench. Each version of WinBench uses profiling based on the applications of its day and the best tools then available; today's applications and profiling tools are different from those of years past. The WinBench 4.0 Graphics WinMark scores happen to be generally lower than the Graphics WinMark scores of Winbench 3.11, but the difference is not significant. There is no meaningful way to compare or translate scores from one version of WinBench to another. And, while WinBench 4.0 works well as a partner with Winstone 94, it does not yield exactly the same re-

sults as Winstone 94.

Even if you hold every part of a system constant except the graphics subsystem, WinBench 4.0 and Winstone 94 will not always rank systems or video cards in exactly the same order. A few factors account for the differences.

One key factor is that WinBench 4.0 is by design a serious graphics stress test that constantly pummels a PC's graphics subsystem. As an overall system test that performs a great deal of disk and CPU activity, Winstone 94 is less stressful on the graphics subsystem. In addition, WinBench uses dithered colors to put more stress on graphics subsystems than Winstone 94 does. Many Windows graphics adapters don't handle dithered colors well, and at least for now, the applications in Winstone 94 don't use them often. Finally, WinBench 4.0 does not currently measure the speed of clipping and some functions that display to off-screen memory; hey, we've got to have something to do for the next release!

Both WinBench and Winstone 94 can be useful video-driver compatibility tests.

While both WinBench and Winstone 94 are speed tests first and foremost, they also have a side benefit: They can be useful video-driver compatibility tests. (WinBench is particularly stressful on video drivers if you run all its graphics tests—something that is not necessary just to produce the Graphics WinMark score.) During our early runs with both kinds of tests we found problems in many different video drivers. We dutifully reported all those problems to the driver vendors; hence, most video drivers today should work with both test suites. Don't be surprised, however, if you—or we—find the occasional video driver that still can't complete the tests of both suites. We've long known that video drivers in general could use a step up in quality; perhaps the team of WinBench and Winstone 94 will help video vendors take that step.

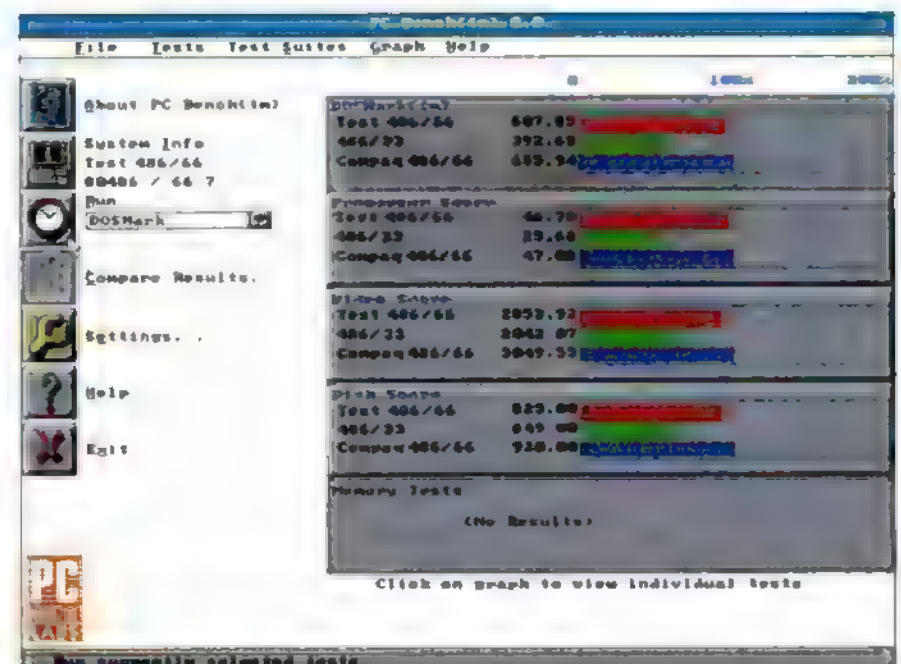


Figure 4: Even though PC Bench 8.0 is a DOS-based program, its interface looks refreshingly similar to that of the Windows-based benchmark tests. Clicking on any one of the graphs lets you drill down to specific tests. A composite PC Bench score, called the DOSmark score, is a summary of the results that estimates overall system performance under DOS.

WinBench 4.0 also includes the Disk WinMark test. As with everything else in WinBench 4.0, this is not the same test we used in Winbench 3.11. The new Disk WinMark test uses a profiling-based disk mix that closely mirrors the way applications use disk subsystems. (For more on our new disk-testing technology, see the discussion of PC Bench 8.0 that follows.)

PC BENCH 8.0 Like its earlier versions, PC Bench 8.0 is a synthetic test suite that produces both system- and subsystem-level scores. It adds significant improvements to the already solid base of the previous version (our Hardware Benchmark Tests, Release 7.01). Our years of experience developing and profiling for PC Bench have given it the ability to summarize subsystem-level results accurately in an overall system-level score that we call the DOSmark. PC Bench 8.0 computes a DOSmark score by using three key subsystem results: the processor score, the disk score, and the video score. The core of PC Bench's processor score is its new 16-Bit Protected-Mode Large Instruction Mix. As the applications have changed, PC Bench's instruction-mix technology has changed with them. The new Large Instruction Mix test reflects the larger working-set sizes that we found during our profiling research. The total working-set size for the Large Instruction Mix is about 450K, which is the working-set size that our research suggests is typical of today's modern applications.

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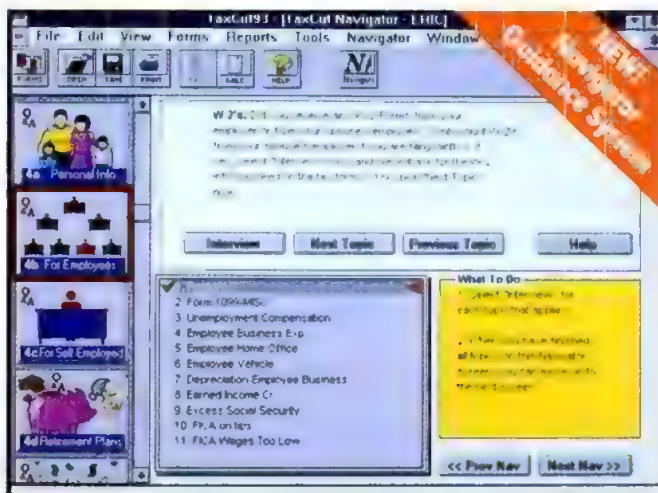
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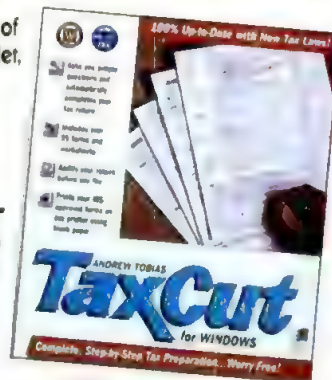
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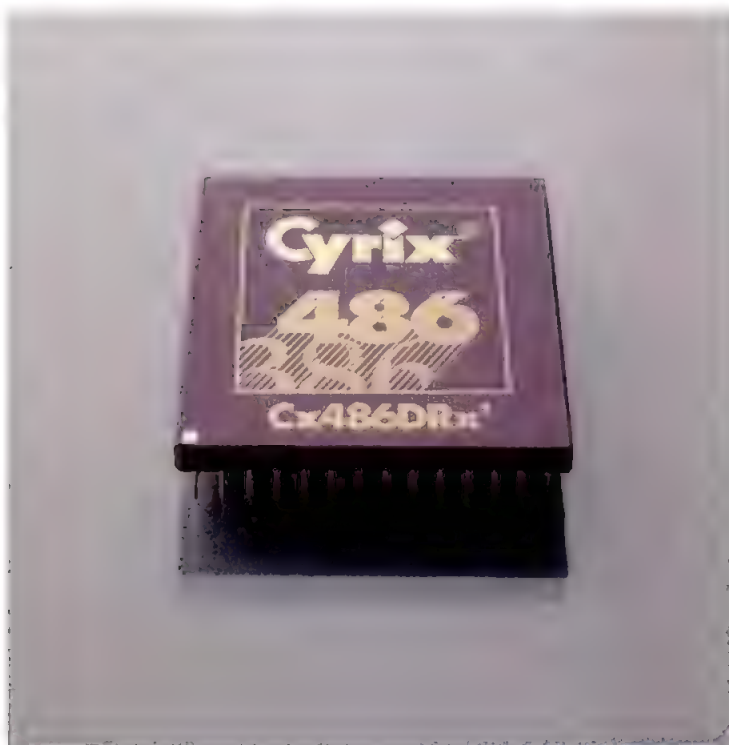
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Advances in our instruction-mix technology have also let us use this single instruction mix in accurately measuring the non-floating-point performance of the entire processor subsystem. The 16-Bit Protected-Mode Large Instruction Mix test accurately mimics the total size of applications, their locality of reference, their L1 and L2 cache hit rates, and their frequencies of instruction use. This new instruction mix also mirrors the way applications use RAM, so we no longer need the memory tests of the previous version of PC Bench to compute the DOSmark. (Those tests are still available as inspection and testing aids, however.) PharLap development tools help the new instruction mix switch smoothly in and out of protected mode. While PC Bench 8.0 relies primarily on this new instruction mix to compute the processor score, the floating-point test also plays a small role in that score.

PC Bench's disk-testing methodology is the site of an even bigger change, with the introduction of disk mix technology. The increased presence and size of both software and hardware disk caches on PCs have made it more important than ever that PC Bench's disk tests accurately reflect the way that applications use disk subsystems. To make that happen, we added a disk test suite to PC Bench 8.0 that performs a broad range of disk activities over a large set of files.

The disk test suite uses more than 100 files spread across six directories, works with multiple files (as many as seven) at the same time, and creates and deletes files. It works with a PC's disk subsystem via the standard INT 21 interface, so you can use it and get accurate results whether or not you're using a software disk cache. The disk test suite moves data in chunks of different sizes, intersperses write and read operations, and generally uses the disk subsystem the way applications do. It also works with data in those files designed to reflect data in the real world. Its test files include data from source code, text, database, binary, executable, and bitmap files.

This use of real data also makes the disk test suite—and all of PC Bench 8.0—perfectly suitable for testing disk subsystems that utilize disk compression. By the way, the disk scores will generally

be generally higher than the DOS disk scores from our Hardware Benchmark Tests, Release 7.01 (expressed in kilobytes per second). That's as it should be, because the current disk test suite reflects the kind of work typical users do and consequently shows the kind of throughput you'll see when using disk caching software and hardware. The old disk tests, by contrast, concentrated primarily on stressing hard disks and disk controllers.

Improved profiling also let us create more accurate video scores. Each video score is a harmonic mean of some individual video tests, including 8- and 16-bit writes to both the text and graphics regions of VGA display memory.

Additional profiling and a battery of testing also let us produce the most accurate DOSmark scores yet (see Figure 4). During one major test run in the development process, the DOSmark score yielded a correlation with performance tests involving popular DOS applications in excess of 99.5 percent—on over 70 machine configurations with and without SMARTDRV. The Disk Throughput, Memory, and Small and Standard Instruction Mix tests from Release 7.01 are also still available as analysis tools.

One area in which PC Bench has long had trouble is in dealing with memory managers. We have made every effort to make PC Bench run with a variety of memory managers, but we still do not recommend testing with memory managers loaded. The reason is straightforward, if a bit obscure: The new instruction mix uses protected mode, but so do most memory managers. The result is that either the instruction mix blocks out the memory manager or the two collide. Either way, we do not recommend PC Bench as a tool for testing or comparing the performance of memory managers. □

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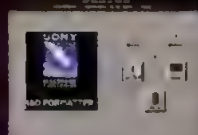
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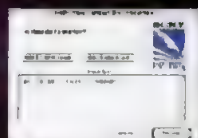
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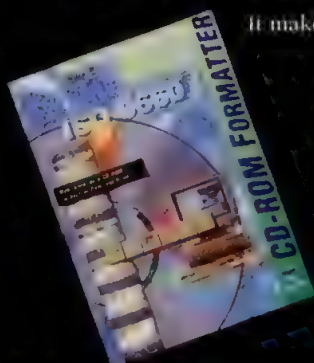
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Corporate Developer

BY SAL RICCIARDI

A Solid Foundation For Your Corporate Applications

Keeping up with the changing world of application development these days is, to say the least, a daunting task. In the early days, you only had to understand MS-DOS and your local PC environment. Now you're as likely to be developing complex Windows-based front-ends to database servers running on a local area network or file-server-based multiuser applications for departmental computing, as you are single-user applications that run on a standalone MS-DOS machine. The complexities involved with designing and developing applications for such multiplatform environments are not trivial. In these pages, we'll help you clear a path through this dense jungle.

Corporate Developer is a new column designed for the needs and interests of *PC Magazine* readers who develop and support departmental applications—standalone or network, single user or multiuser, file-server or client/server. We'll offer in-depth coverage of issues facing corporate developers, whether you're designing a front-end for a local SQL database or creating a wide area network to move data from your home office to a branch seven time zones away.

THE AGENDA The scope of our efforts will be rather broad. After all, you need to learn and develop an ever-increasing and demanding set of skills in order to succeed as a corporate developer. Because so many applications developed today involve some form of database ac-

cess, we'll delve into database topics often, but we won't limit our coverage to just one platform or product. And in order to bring you in-depth coverage of such a broad range of topics, we'll use the industry's brightest writers who are experienced hands in the field of corporate development. In future issues, you'll find articles on developing client/server applications, developing multiuser applications, and database programming using a variety of different tools and DBMS products.

A few years ago, programming professionals generally fell into one of two groups: those who used a low-level language such as C, and those who used the high-level application development tools provided with database management products. In recent years this line has blurred a great deal. For example, high-level database developers need to learn C in order to write extensions that provide missing features in their favorite product. On the other hand, C developers need to learn about designing database structures so they can write robust client/server applications. The one technology common to both groups—that forms the foundation of most applications developed today—

is the database. Just as the wise man builds his house upon the rock, so too must your application have a solid foundation. Let's build that foundation with a simple but somewhat accelerated review of the principles for good database design and management.

WHAT IS A DATABASE? A database is an organized collection of information. The type of information doesn't matter. It can be any kind, from detailed financial records about your business to a list of contact names to the parts list that accompanied that barbecue grill you just put together. For example, the local telephone book is a database of names, addresses, and phone numbers, and a dictionary is a database of words and their meanings. Both are organized collections of information.

In a relational database, information is organized into tables: lists of rows and columns reminiscent of an accountant's pad or a typical spreadsheet. For example, consider an employee table like the

one shown in Figure 1. In this table, each employee occupies one row in the list, and the information items related to each employee are arranged in named columns. For each employee, the items recorded include employee number, last name, and first name. Each employee row is also called a *record*, and each column is also called a *field*. A record is a meaningful and consistent way to combine in-

formation about something. A field is a single item of information—an item type that appears in every record.

A table stores information about a particular subject (such as employees or machine parts). Often you'll need to store more than one type of information, so you'll need more than one table. For example, an inventory tracking system may need several tables, including a Products table, a Customers table, and an Orders table. A database, then, is defined as a collection of one or more tables, as shown in Figure 2.

There is no shortage of terms used to

*In these pages we'll help
you deal with the
complexities involved
with designing and
developing applications
for multiplatform
environments.*

Employees Table

	Employee number	First name	Last name
Record (row, tuple)	000001	Solomon	Smudley
	000002	Susan	Smagurkee
	000003	Stanley	Smiley
		Field (column, attribute)	

Figure 1: A table is a collection of records and fields containing data values. A record is a meaningful and consistent way to combine information about something. A field is a single item of information—an item type that appears in every record.

represent major objects or structures in a database. You've just learned the common relational database terms: *table*, *row*, and *column*. And you know that a row is the same as a record, and a column is the same as a field. The terms *record* and *field* come from the general province of data processing, where they are often used to represent data structures in file-processing applications. Some commercial software packages also use the term *file* or *database file* to refer to a table. (I'm thinking of Xbase packages, for instance, such as Borland's dBASE or Microsoft's FoxPro.) This usually refers to the way the package physically stores tables (in separate files), or otherwise hints that the product has its origins in file processing.

You will also come across other terms in the database literature; the relational model is based on mathematical concepts that are expressed using different terminology. For example, the mathematical term for a table is a *relation*. A row is called a *tuple*, and a column is called an *attribute*.

DATABASE MODELS The overwhelming majority of available PC-based database products support the relational database model—to one degree or another. A database model describes at a high level the abstract objects supported by a database system and the manner in which those objects relate and interact. For example, the relational database model specifies that information should be presented logically in the form of tables,

rows, and columns, and defines the operations and rules that should be supported by a relational system.

There are, however, other database models. A thorough discussion of database models and the relational model is beyond the scope of this introduction, but as a point of reference, the hierarchical and network models repre-

sent two other well-known database models. Briefly, the hierarchical model places information in a parent/child hierarchy, where parent records lead to lower-level child records, much like a typical organization chart. The network model is basically an extension of the hierarchical model but allows child records to have more than one parent (or more precisely, any number of parents).

DATABASE MANAGEMENT SYSTEMS A database management system, or DBMS, is a set of tools that lets you manage the data stored in a database. A database management system stores the information and gives both the user and programmer access to a set of data manipulation tools. Normally these include the ability to add, change, or delete records; to search for and retrieve specific records;

to organize and view information in different ways; to produce output in the form of reports; and to perform administrative functions such as creating indexes (special data structures used to provide rapid access to information).

Most products provide access to these functions interactively. In addition, you can usually access these features from a database language such as SQL (structured query language) or a low-level programming language such as C coupled with a vendor-supplied API (application programming interface). Figure 3 graphically depicts how this works.

The advantage of a database management system is that it relieves you of worrying about the low-level, physical details. For example, you can select records by naming tables and columns and supplying test values and conditions, but you do not need to know how the information is physically stored on-disk. Instead, you supply your request in logical terms, and the system returns the answer. Because you're insulated from the physical details, you can concentrate on the logical structure of your information. In fact, a major goal of a good DBMS is to allow changes to physical storage or access mechanisms without having them affect applications that use the database. This is possible because external applications work with a logical model, while the DBMS worries about all of the physical details.

A good DBMS should also include features that provide security, data integrity, concurrency, and recovery. To put it simply, *security* means allowing database access only to approved users and applications. *Data integrity* features help ensure the accuracy and consistency of the information that is stored in your database. For example, if you correct an employee number, the correction should be applied to every table where the employee number appears. *Concurrency* refers to support for access by multiple users or processes at the same time, without causing interference. And *recovery* concerns the ability to restore the database to a correct state after an error (such as hardware failure) occurs.

I should note that not all products that are called DBMSs provide built-in support for all of these capabilities; some-



Figure 2: In the relational database model, a database is a collection of one or more tables.

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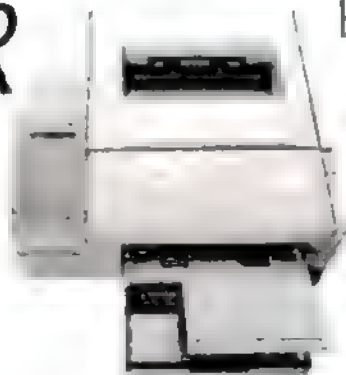
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times they don't support any. In many cases you have to write custom program code if you want to implement data integrity rules, for example. The disadvantage of such programmatic approaches is that they can often be bypassed by interactive users, and they have to be repeated in every custom application developed. The alternative is to support the creation of

such rules as part of the database definition itself so that they are enforced globally, whether the database is accessed programmatically or interactively.

PLANNING A DATABASE Before you can create a database, you must plan its logical structure and provide that information to your DBMS. Ultimately this means deciding what tables you need and what columns to include in each table. To begin planning a database, you must think about the kinds of information you want to include in the database and the kinds of information you want to get out. Your goal is to identify all of the unique types of information (customer names, product codes, order numbers, and so on) that you'll need to store in the database. You can think of this process as an investigative, data-gathering process. Involve those who will work with the database in any way, and devote as much time to this stage as possible.

Let's consider a simple example that illustrates how the process works: Suppose you're the owner of Sam's Bookstop, a bookshop and mail-order bookseller specializing in best-sellers and computer books. You need a database to track your customers. The database should record important information about customers—names, addresses, phone numbers—so that you can produce printed reports and form-letter mailings.

A good place to start planning the new

database is to examine your existing information. First, look for all of the possible sources of information for the database. For example, you might currently have customer information stored on forms or purchase orders in a file cabinet. If so, gather those documents and identify each type of information shown (for example, each box that you fill in on the form). If you don't have any existing forms, imagine instead that you have to design a form to record customer information. What information would you include on the form? What fill-in boxes would you create? Take your time to identify and list each one of these items. For example, suppose the customer list is currently stored on index cards. An examination of these cards might show that each card holds a customer's name, address, city, state, ZIP code, and phone number. Each of these items is a potential column in a table.

Next think of the reports or other forms of output that you want from your database. For example, you might want a customer report listing all of your customers and their addresses. You might also want to print customer form letters to announce a sale event. Imagine what such a report would look like. What information would you put on the report? Give it some thought and then list each item. Do the same for the form letter. You might want to draw up printed samples to help you with this process.

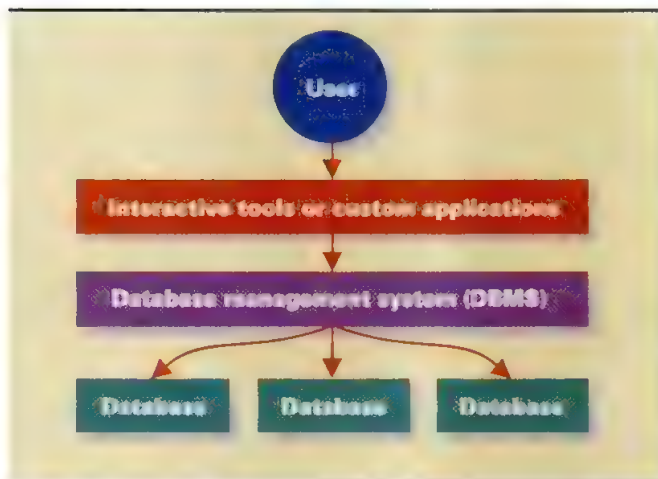


Figure 3: A database management system stores information and provides user access to that information via interactive tools or custom applications developed using a high-level language like a SQL—or a low-level language like C coupled with a vendor-supplied API.

Thinking of the output reports will often reveal new types of information that you need to include. For example, suppose you want to show on the report which customers would like to receive catalog mailings. To record that information, you'll need to add a Send Catalog? field to the customer database. Then for each individual customer you can set that field to Yes or No according to their preference.

Consider, too, the form letter. The parts of the letter that change usually include the name and address of the person or organization to whom you address the letter. As you imagine the form letter, or examine your printed sample, do you see any information items that you might need to store in the database? For instance, you probably begin each letter with a salutation like Dear Mr. Smudley or Dear Mrs. Smagurkey. The Mr., Mrs., or Ms. that starts the greeting changes for each letter depending on the customer. Unfortunately, the computer doesn't know the difference between a Mr., a Mrs., or a kangaroo unless you tell it. For that reason you'll also need a Salutation column in the customer database.

Notice that the salutation only includes the last name, not the first name. This means the DBMS will need to access only the last name to print on the letter, something it can't easily do if the entire name is stored in a single long column. In order to make the last name separately available, you'll have to break up the name into two parts: First Name and Last Name. This brings up an important point to remember when planning a database: Always split each item of information into its smallest useful parts. Clearly we'll make better use of Last Name if it's in a separate field. Here's a good rule of thumb: If you need to report, sort, search, or calculate based on an item of information, be sure to put that item in a field all by itself.

Now that you've considered all the reports you might need, the next step is to determine what questions you need to have answered and what information is needed to answer them. For example, if you're Sam, here are some questions you might want to ask of the Sam's Bookstop customer database: What customers have placed an order within the last six

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CENTRAL POINT

months? What customers live in New York State? What customers have bounced checks or pose a credit risk?

If you consider these questions carefully, you'll discover that each one suggests another change to the field list. How will you know when a customer last placed an order? You'll have to record the date when each order is placed, so your database will need a Date of Last Order field. Most DBMS products let you perform calculations using dates, so once the date information is stored in the database it's easy to find out which of your customers placed an order within the last six months.

To answer the second question and list those customers who live in New York State, you have to be able to search the State field by itself. Thus, you'll need to ensure that the City, State, and ZIP Code fields are stored in your database as separate fields (note that this follows our rule of breaking up information into its smallest useful parts). There are some other good reasons to keep these fields separate. For example, you might want to

search the City field for customers who live in a particular city or sort a report by ZIP code. This kind of search would be difficult to do if City and ZIP Code were embedded in the State field.

Finally, to answer the third question and list customers who have bounced checks or are otherwise a credit risk, you'll need to add a Credit Allowed? field to the database. That way you can set the field to Yes or No for each customer.

You may be tempted to jump right in and start designing your database, but spending time at this stage pays off, because it will give your application a strong foundation. After examining the data items to be stored in the database and the intended output, you've really completed only the first step in planning a database. Future Corporate Developer columns will delve deeper into the topic of database design.

FURTHER READING For further information on database technology, I recommend the following books:

- *An Introduction to Database Systems,*

Volume I, Fifth Edition, by C.J. Date, Addison-Wesley, Reading, Massachusetts, 1990.

- *An Introduction to Database Systems,* Volume II, by C.J. Date, Addison-Wesley, Reading, Massachusetts, 1983.

- *The Relational Model for Database Management: Version 2,* by E.F. Codd, Addison-Wesley, Reading, Massachusetts, 1990.

- *Database Management and Design,* by Gary W. Hansen and James V. Hansen, Prentice-Hall, Englewood Cliffs, New Jersey, 1992.

THE MAILBOX Please send any comments, questions, or suggestions to Dale Lewallen, Senior Editor (MCI: 338-5922, CompuServe: 72241,1773) or Sal Ricciardi, Contributing Editor (MCI: 347-7663, CompuServe: 72241,33). □

SAL RICCIARDI IS A CONTRIBUTING EDITOR TO PC MAGAZINE AND AUTHOR OF *RUNNING MICROSOFT FOXPRO FOR WINDOWS AND RUNNING MICROSOFT FOXPRO FOR MS-DOS*, FROM MICROSOFT PRESS.

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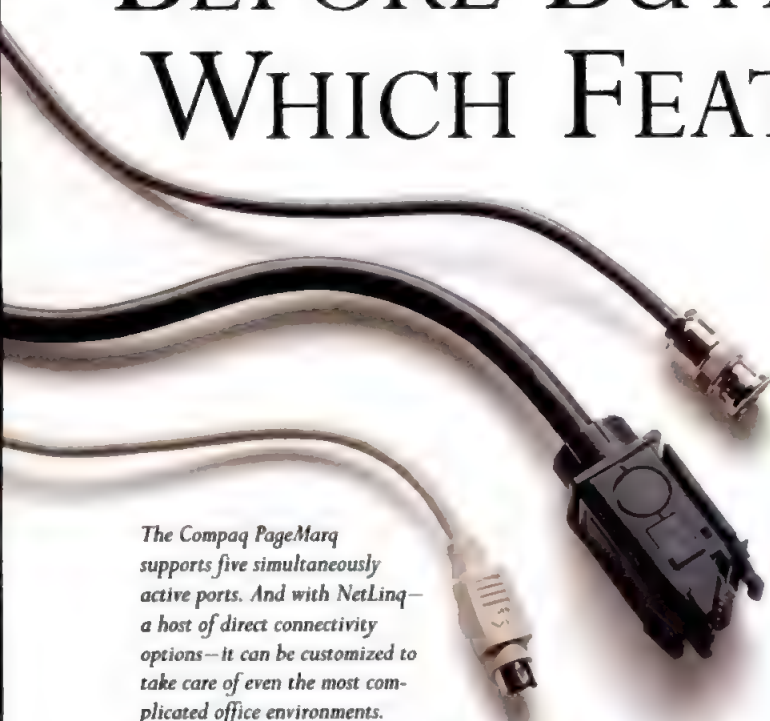


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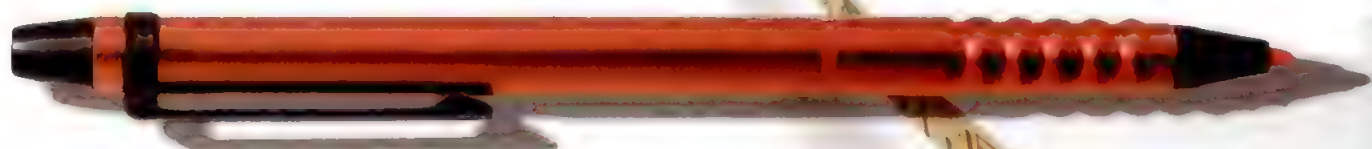
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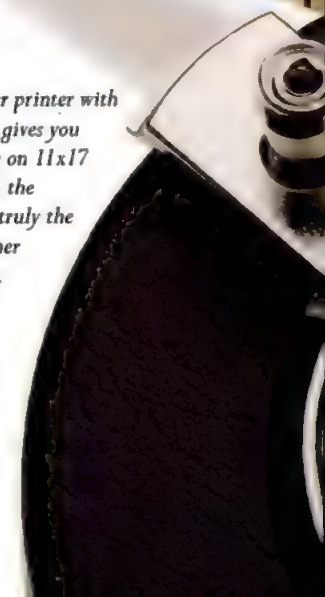
It may be hard to imagine the world before fax machines, but it's not hard to imagine a world where they're no longer necessary. With PageMarq's internal fax modem, you can send and receive genuine Adobe PostScript documents in sizes up to 11x17.



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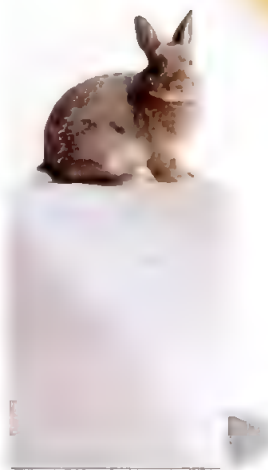


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Toolkits

BY DOUGLAS BOLING

Spy on Programs With WinScope

WinScope, from The Periscope Company, is an event-capture tool that can display reams of information about your Windows programs. If you think of WinScope as a message "spy" program on steroids, you would be only one-third right. Other event-capture programs, such as the Windows SDK's Spy or Borland C++ compiler's WinSight, let you watch messages but stop there. WinScope also lets you capture the API calls an application makes, and it can use Windows' hook mechanism to provide even more information. More than 1,200 Windows API calls (almost 200 of them undocumented) and hundreds of Windows messages are "known" by WinScope. Additional API functions and messages can be added with the scripting feature.

WinScope is useful as a debugging tool, allowing you to watch messages come in and to observe the success or failure of API calls. But it is also a terrific educational tool. You can monitor existing programs and discover how they work. This is not reverse engineering—you don't get a disassembly of the program—but by observing the messages the program responds to and the API calls it makes, you can get a good idea of how to do the same thing in your programs.

CAPTURES MESSAGES AND MORE

Like Spy and WinSight, WinScope lets you choose which windows to spy on and can display the messages that are sent or posted to a window. But WinScope also adds the ability to preenter the class name of a window that has yet to be registered so that you can capture

messages during the window's initialization. This unusual feature is handy in tracking down those pesky program initialization bugs.

WinScope can also display the calls an application makes to the Windows' API or to other DLLs, and will note when bad parameters are passed. In conjunction with the message-capture feature, the API trace lets you see which calls an application makes as a result of which messages. WinScope can also use the Windows hook system to dump information on hardware, track mouse events, or provide other system information. After each event, WinScope lists the time elapsed since the previous event so you can check how long certain parts of a program are taking.

A scripting feature lets you add to the vast list of messages, API functions, and hooks that WinScope knows about. Scripts can be written in two ways: by manually using the script language or by using the script-extractor utility to examine an executable file (.EXE, .DLL, .DRV, or .VBX) and to extract a list of external function calls. You still must edit the list in order to add the parameters for each function, but this utility is a helpful start.

MANAGING THE FLOOD OF INFO WinScope presents all this information in an MDI window, with child windows showing the trace information, window list, module list, messages, APIs, and hooks. The trace window is the destination for all information gathered, regardless of the source. Although it is easy to lose a specific child window in the clutter, each

window can be brought to the fore with a hotkey. WinScope can also save and restore specific window configurations.

To keep you from being deluged with extraneous information, WinScope lets you specify which events to monitor and which windows and code modules to watch. A Find dialog box lets you search any window for a word or phrase. Finally, WinScope can be configured to capture events only under certain conditions. For example, you can set WinScope to capture hook events only inside API calls and ignore WM_MOUSEMOVE messages except when an application has "captured" the mouse.

WinScope's ability to trigger external debuggers such as CodeView adds to its usefulness in tracking problems. You can signal a debugger with a breakpoint when WinScope detects a specific event. WinScope also lets you trigger debuggers with a combination of events—something that most debuggers will not let you do on their own.

WinScope can set up to 16 breakpoints and allows a number of passes through the breakpoint before breaking to the debugger. You can also capture messages *after* the breakpoint in order to see the consequences of the event.

WinScope's 112-page manual is brief but complete. It includes some short examples, a reference section, and an appendix on the Windows messaging system. Another welcome touch is a description of the keywords used in

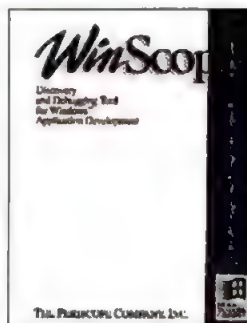
the WinScope INI file.

WinScope boasts features offered by no other event-capture program, providing a high-level view of how Windows and Windows applications work together. If you want to see what is happening behind the scenes in a Windows program, WinScope can provide the vision.

• WinScope, Version 1.1

List price: \$249 (\$199 until January 1, 1994). Requires: Microsoft Windows 3.1. The Periscope Company Inc., 1475 Peachtree Street, #100, Atlanta, GA 30309; 800-722-7006; 404-888-5335; fax, 404-888-5520.

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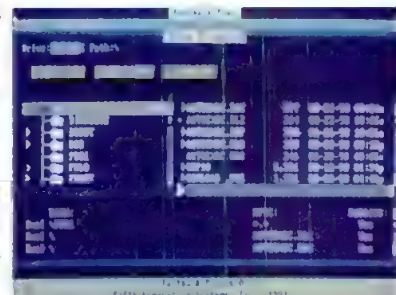
After they'd selected the file they wanted, they figured Fastback ought to tell them when it was backed up, what type of media it was backed up to and what type of backup it was.

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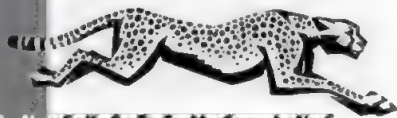
"Sure," they said, and asked if Version 6.0 could do dishes and take out the trash.

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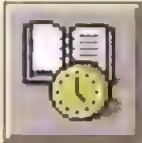
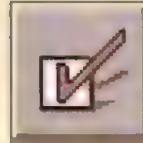
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WordPerfect Office



Environments

BY CHARLES PETZOLD

Typing Unicode Characters from the Keyboard

In 1963, the Swedish Parliament decided that automobiles in Sweden should no longer be driven on the left side of the road. They set a date for changing to right-side driving and spent \$120 million over the next four years in preparation for this momentous event. And so on Sunday, September 3, 1967, folks who were out driving at 6:00 A.M. slowed down their cars, eased over to the other side of the road, and continued on their way. Amazingly enough, this migration succeeded with only minor accidents. Well that's *one* way to change a standard!

Of course, most changes in standards require a long transition period. Some standards, such as 110-volt electrical outlets, may never change. Others, such as the consumer switch from LPs to CDs, happen much faster than anyone would have anticipated, despite the hardware and software upgrades required. Over the next decade, the switch to a high-definition television (HDTV) standard will be a very interesting event.

As we've often seen, transitions in computer standards are usually rather awkward, because the transition period almost always involves the support of multiple standards. For example, many PCs now routinely include both 5.25- and 3.5-inch floppy disk drives, each of which must support both low- and high-density disks. Operating systems must be backward compatible: Windows must run DOS applications, while Windows NT must run Windows applications *and* DOS applications. And while non-Windows

DOS applications seem to be on the decline (finally), it's likely that DOS may refuse to die for a very long time. Witness the longevity of COBOL, for example.

THE UNICODE STANDARD In recent columns, I've been treating Unicode as if its adoption as an industry standard is inevitable. Well, I certainly hope so. But the whole idea of Unicode is to replace ASCII, and ASCII is possibly the most entrenched personal computing standard imaginable. It would be nice if the computing equivalent of the Swedish Parliament simply decreed that Unicode would replace ASCII four years from now, and then allocated millions of dollars to convert every existing computer program to the new standard. But it's really up to the developers and programmers to make the change, and this can only be done if programs are written for an operating system that supports Unicode, such as Windows NT.

ASCII is a 7-bit character encoding (although these days, 8 bits are almost always used to provide an additional 128 characters), and Unicode is a 16-bit encoding. That change in character representation has a potentially highly disruptive effect on program code, to say the least. But we've seen in previous columns

how the ANSI C language definition, the ANSI C runtime library, the non-ANSI extension header file included with Microsoft's Win32 Software Development Kit, and Windows NT itself all provide solutions that make the transition to Unicode relatively painless.

In the last issue, I presented a program called UNICHAR that was basically an ASCII program but included some Unicode support to display all the characters of the Lucida Sans Unicode TrueType font. This font (included with the retail release of Windows NT) is not a complete Unicode font, but it contains extended Latin, Cyrillic, Greek, and Hebrew character sets and some symbol sets. In this column, we'll write a short Windows NT program that can be compiled to support either plain old ASCII—rather, the original Windows ANSI character set and eight-bit ASCII extension—or Unicode.

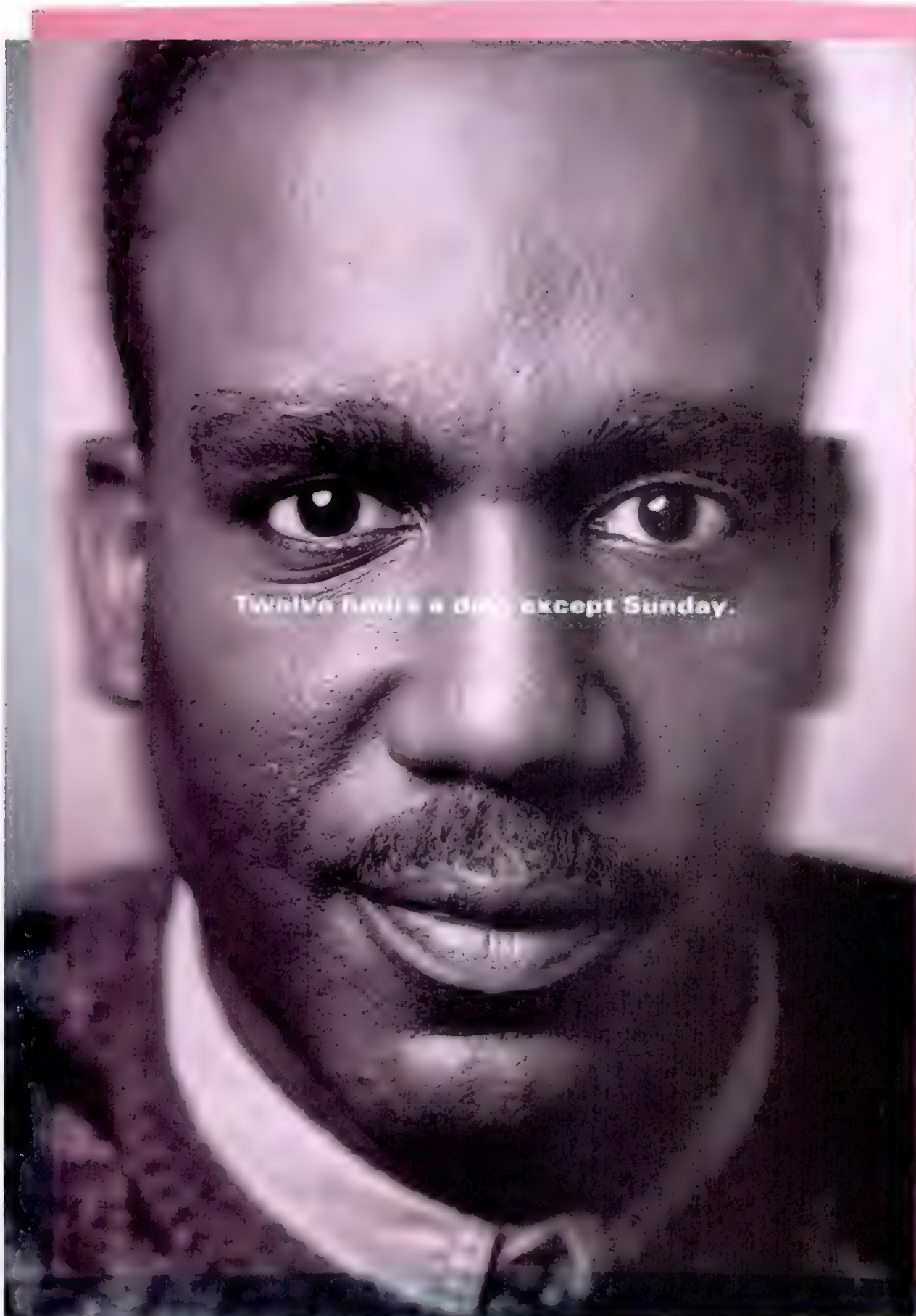
CONVERSION HURDLES Windows programmers are already facing the chore of porting their existing programs to Windows NT. How does Unicode fit into this conversion process?

The first step in converting an existing 16-bit Windows program to NT is to take advantage of the transition subset API known as Win32s. By using only those Win32 function calls that are 32-bit enhancements of Win16 function calls (plus a few others), you can create a Windows NT program that also runs under Windows

3.1 (with the help of some dynamic link libraries). For the time being, the Windows 3.1 market is much larger than the NT market, but the single Win32s executable will run under both of these platforms.

Win32s does not support Unicode. But during the process of converting existing code to the Win32s API, you can also make those changes that will allow the program to be compiled for either ASCII or Unicode. Making the extra effort now while you're changing your code may ease the later conversion to a full-

The whole idea of Unicode is to replace ASCII, and ASCII is possibly the most entrenched personal computing standard imaginable.

A black and white close-up portrait of a man with a mustache, looking directly at the camera. The text "Twelve hours a day except Sunday." is superimposed over his face. The man has a serious expression and is wearing a dark jacket over a light-colored shirt. The background is dark and out of focus.

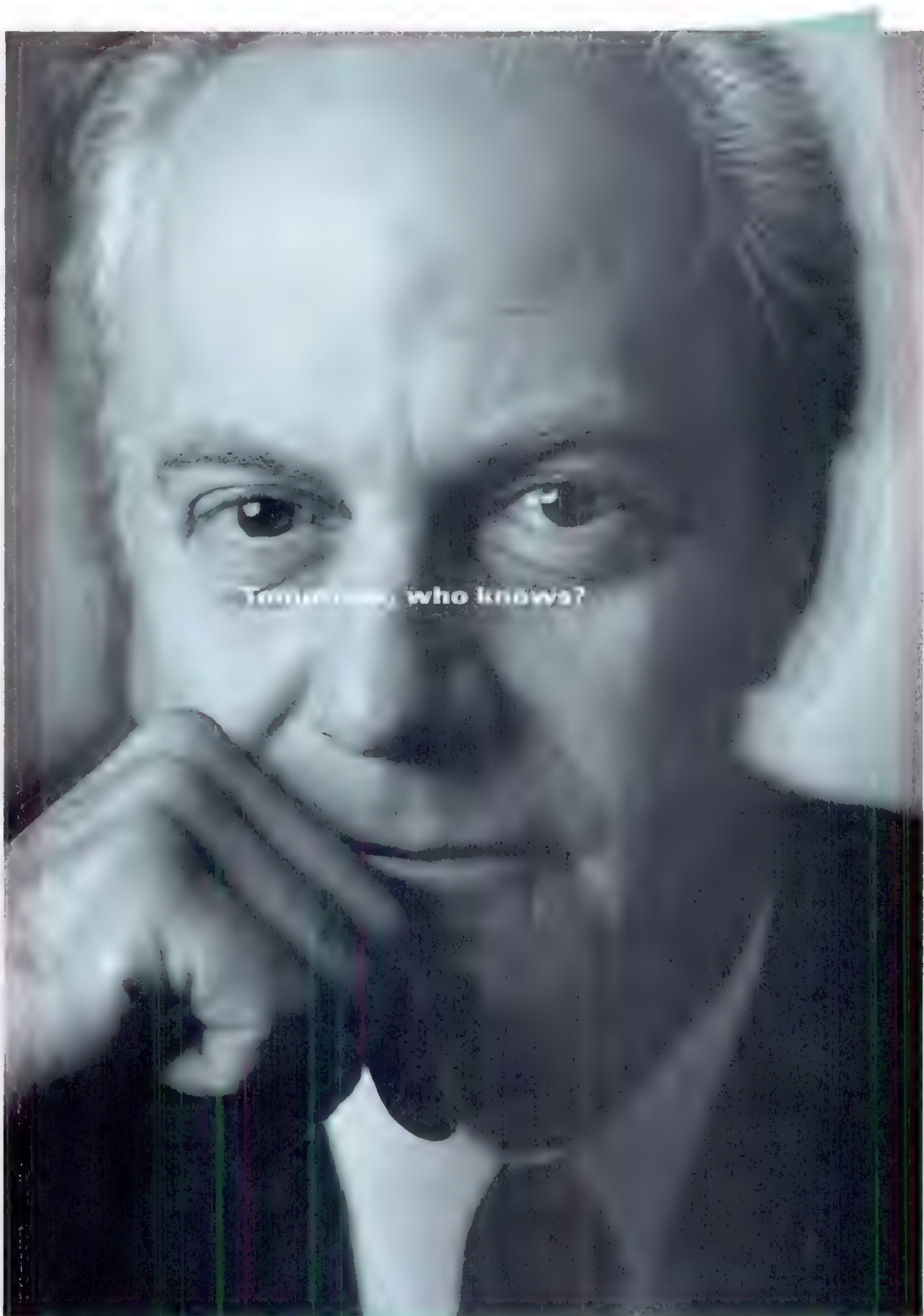


Four hours Monday, six hours Tuesday, eight hours...

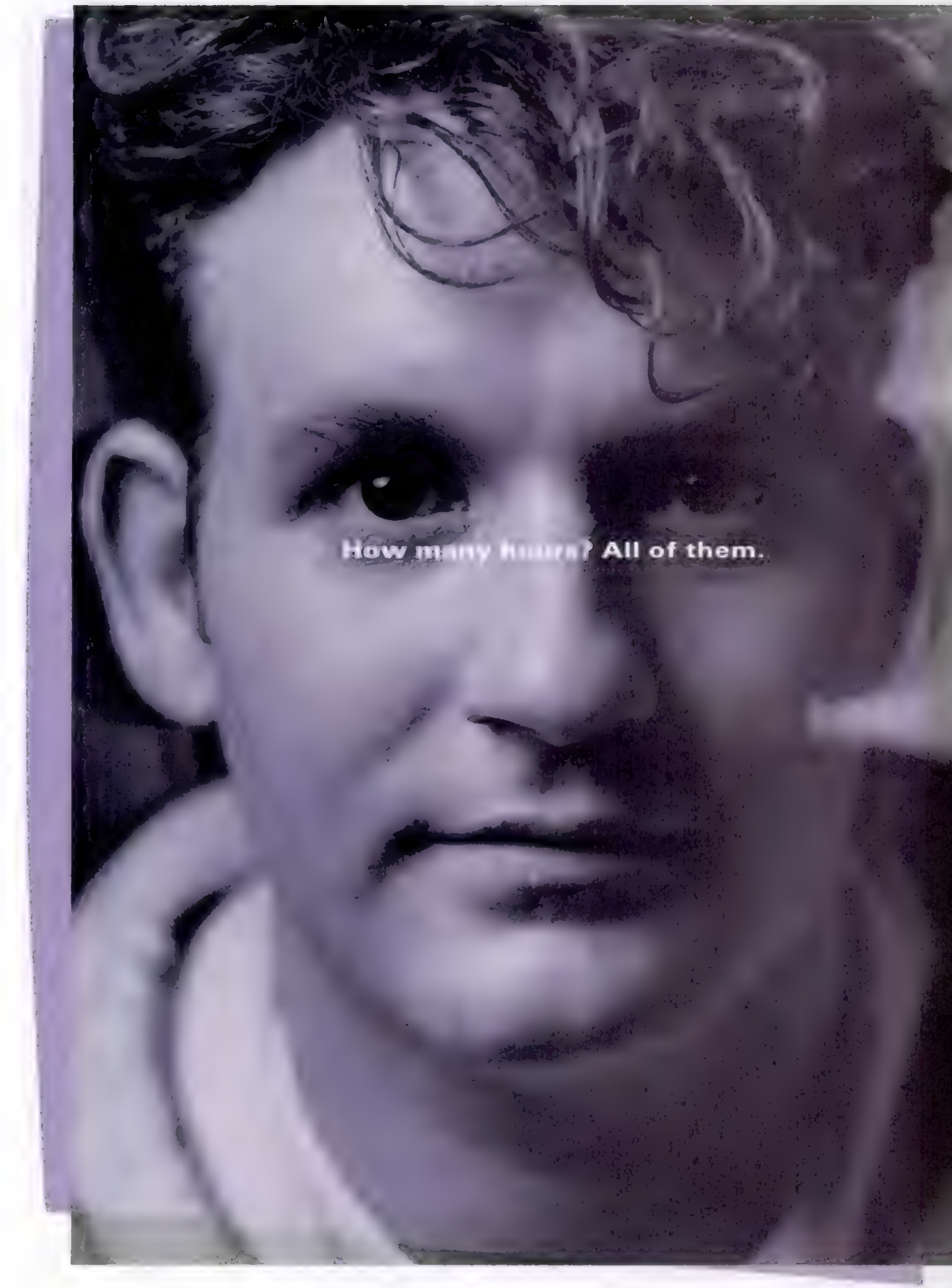




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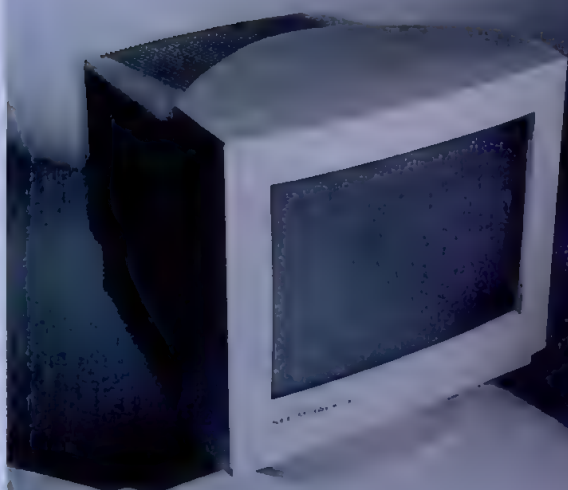
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UNITYPEA.MAK

Complete Listing

```
#-----
# UNITYPEA.MAK make file
#-----

!include <ntwin32.mak>

unitypea.exe : unitypea.obj unitype.rbj
$(link) $(guiflags) -out:unitypea.exe unitypea.obj unitype.rbj $(guilibs)

unitypea.obj : unitype.c unitype.h
$(cc) $(cflags) $(cvars) -J -Founitypea.obj unitype.c

unitype.res : unitype.rc unitype.h
$(rc) $(rcvars) -r unitype.rc

unitype.rbj : unitype.res
cvtres -$(CPU) unitype.res -o unitype.rbj
```



Figure 1: This make file is for creating UNITYPEA.EXE, the ASCII version of the UNITYPE program.

blown Win32 application that takes advantage of more NT features. If done right, making these changes for future Unicode support won't prevent your program from being compiled for Win32s.

TEXT AND THE KEYBOARD In past columns, we've seen how a program can store, manipulate, and display text strings of Unicode characters. But where does a program get text? Some text is hard-coded in programs, either in the source code or in resource files. Some text comes from reading files. Text could come from remote sources through the telephone lines and the communications port, and, of course, users type text from the keyboard. The last is the source of text I'll discuss here.

The primary rule for dealing with the keyboard is: Trust the keyboard driver and the WM_CHAR message. If the WM_CHAR message delivers a Unicode character to your program, it's not usually necessary for the program to figure out what that character is—just use it as you'd use an ASCII character. In most cases, that means echoing it back to the display and storing it in memory.

Let's look at a program called UNITYPE, shown in Figures 1 through 5. This program processes the WM_CHAR message to display the corresponding character of the Lucida Sans Unicode font enlarged to the full height of the client area. The program also displays the hexadecimal code for the character using the normal system font. Each character you type replaces the preceding one.

I've provided two make files for compiling and linking the ASCII and Unicode versions of the program: UNITYPEA.MAK (the ASCII version) and UNITYPEW.MAK (the wide-character Unicode version). Using the Microsoft Win32 Software Development Kit, you can create UNITYPEA.EXE by executing the following:

NMAKE UNITYPEA.MAK

from a Windows NT command line and UNITYPEW.EXE similarly. Or you can download the source code and executables from PC MagNet's Programming forum. All files are archived under the name TYP.ZIP.

SINGLE SOURCE What's important to realize here is that the ASCII and Uni-

code versions of this program are compiled from a single source: UNITYPE.C. Moreover, UNITYPEA.EXE is a Win32s program that you can run under Windows 3.1 (provided you've installed the Win32s support from the Win32 SDK CD-ROM). UNITYPEW.EXE, however, requires Windows NT.

Some parts of this program (such as the font-selection dialog box logic) are similar to last issue's UNICHAR program, so I won't discuss them again. Instead, I'll point out what you need for a single source that can be compiled for either ASCII or Unicode. I've discussed the basic principles in past columns, but here's where it all comes together:

First, take a look at the file UNITYPEW.MAK. You'll note on the compile command line that the -D flag is used to define two constants: UNICODE and _UNICODE. The constants are not defined in the compile command in UNITYPEA.MAK. The first flag is used in the Windows NT header files to select the Unicode versions of NT functions and data types. The flag with the underscore is used in TCHAR.H to select the wide-character versions of C runtime library functions, which are defined in WCHAR.H.

Second, the UNITYPE.C program includes both TCHAR.H and WCHAR.H, as well as the more customary header files STDIO.H and STRING.H, which define the ASCII versions of three runtime library functions used in the program.

Third, all character variables are de-

UNITYPEW.MAK

Complete Listing

```
#-----
# UNITYPEW.MAK make file
#-----

!include <ntwin32.mak>

unitypew.exe : unitypew.obj unitype.rbj
$(link) $(guiflags) -out:unitypew.exe unitypew.obj unitype.rbj $(guilibs)

unitypew.obj : unitype.c unitype.h
$(cc) $(cflags) $(cvars) -DUNICODE -D_UNICODE -Founitypew.obj unitype.c

unitype.res : unitype.rc unitype.h
$(rc) $(rcvars) -r unitype.rc

unitype.rbj : unitype.res
cvtres -$(CPU) unitype.res -o unitype.rbj
```



Figure 2: This make file is for creating UNITYPEW.EXE, the Unicode version of the UNITYPE program.

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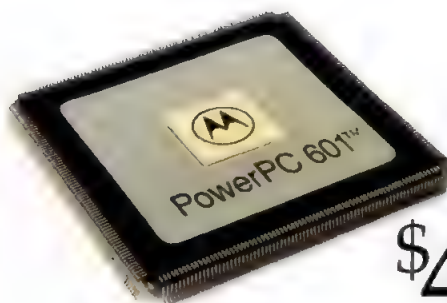
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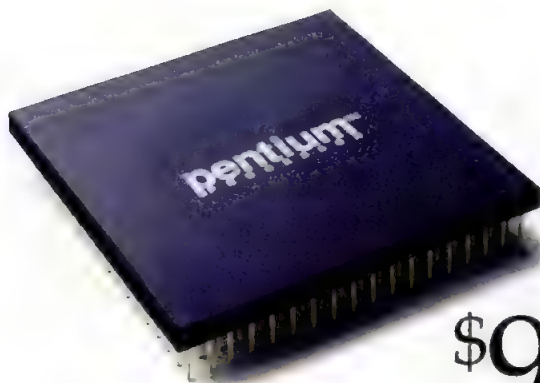
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CIRCLE 385 ON READER SERVICE CARD

UNITYPE.C

Complete Listing

```

/*-----
UNITYPE.C -- Type Unicode Characters
(c) Charles Petzold, 1993
-----*/

#include <windows.h>
#include <commdlg.h>
#include <stdio.h>
#include <string.h>
#include <wchar.h>
#include <tchar.h>
#include "unitype.h"

long APIENTRY WndProc (HWND, UINT, UINT, LONG);

int PASCAL WinMain (HANDLE hInstance, HANDLE hPrevInstance,
LPSTR lpszCmdLine, int nCmdShow)
{
    static TCHAR szAppName[] = TEXT ("UniType");
    HWND        hwnd;
    MSG          msg;
    WNDCLASS     wndclass;

    if (!hPrevInstance)
    {
        wndclass.style          = CS_HREDRAW | CS_VREDRAW;
        wndclass.lpfnWndProc    = WndProc;
        wndclass.cbClsExtra     = 0;
        wndclass.cbWndExtra     = 0;
        wndclass.hInstance      = hInstance;
        wndclass.hIcon           = LoadIcon (NULL, IDI_APPLICATION);
        wndclass.hCursor         = LoadCursor (NULL, IDC_ARROW);
        wndclass.hbrBackground  = GetStockObject (WHITE_BRUSH);
        wndclass.lpszMenuName    = szAppName;
        wndclass.lpszClassName   = szAppName;

        RegisterClass (&wndclass);
    }
    hwnd = CreateWindow (szAppName, TEXT ("Type Unicode Characters"),
        WS_OVERLAPPEDWINDOW,
        CW_USEDEFAULT, CW_USEDEFAULT,
        CW_USEDEFAULT, CW_USEDEFAULT,
        NULL, NULL, hInstance, NULL);

    ShowWindow (hwnd, nCmdShow);
    UpdateWindow (hwnd);

    while (GetMessage (&msg, NULL, 0, 0))
    {
        TranslateMessage (&msg);
        DispatchMessage (&msg);
    }
    return msg.wParam;
}

long APIENTRY WndProc (HWND hwnd, UINT message, UINT wParam, LONG lParam)
{
    static CHOOSEFONT cf;
    static LOGFONT     logfont;
    static TCHAR        ch;
    HDC                 hdc;
    PAINTSTRUCT          ps;
    TCHAR               szBuffer [8];

    switch (message)
    {
        case WM_CREATE:
            _tcscpy (logfont.lfFaceName, TEXT ("Lucida Sans Unicode"));

            cf.lStructSize      = sizeof (CHOOSEFONT);
            cf.hwndOwner        = hwnd;
            cf.lpLogFont         = &logfont;
            cf.Flags             = CF_INITTOLGFONTSTRUCT | CF_EFFECTS |
                CF_SCREENFONTS;

            return 0;

        case WM_SIZE:
            logfont.lfHeight = HIWORD (lParam);
            return 0;

        case WM_COMMAND:
            switch (wParam)
            {
                case IDM_FONT:
                    if (ChooseFont (&cf))
                        InvalidateRect (hwnd, NULL, TRUE);

                    break;

            }
            return 0;

        case WM_CHAR:
            ch = (TCHAR) wParam;
            InvalidateRect (hwnd, NULL, TRUE);
            return 0;

        case WM_PAINT:
            hdc = BeginPaint (hwnd, &ps);

            SetTextAlign (hdc, TA_UPDATECP);
            MoveToEx (hdc, 0, 0, NULL);

            SelectObject (hdc, CreateFontIndirect (&logfont));
            SetTextColor (hdc, cf.rgbColors);

            TextOut (hdc, 0, 0, &ch, 1);

            DeleteObject (SelectObject (hdc, GetStockObject
(SYSTEM_FONT)));
            _stprintf (szBuffer, TEXT ("%X"), ch);

            TextOut (hdc, 0, 0, szBuffer, _tcslen (szBuffer));

            EndPaint (hwnd, &ps);
            return 0;

        case WM_DESTROY:
            PostQuitMessage (0);
            return 0;
    }
    return DefWindowProc (hwnd, message, wParam, lParam);
}

```



Figure 3: UNITYPE.C displays Unicode characters typed from the keyboard to the client area.

defined using the TCHAR data type. The Windows NT header files define TCHAR to be the same as a char data type if the UNICODE constant is not defined, and a 16-bit unsigned short otherwise.

Fourth, all literal text strings in UNITYPE.C are enclosed in the TEXT macro. This macro is defined in the Windows NT header file to append the letter L to the beginning of text strings if the UNICODE constant is defined, instructing the compiler to interpret each character in the string as a 16-bit value.

Fifth, the runtime library functions

used in the program to manipulate strings are the ones defined in TCHAR.H. These are _tcscpy (to copy a string), _stprintf (to format a string), and _tcslen (to obtain the length of a string). If the _UNICODE identifier is defined, TCHAR.H defines these names to be the wide-character functions: wcscpy, swprintf, and wcslen. If _UNICODE is not defined, then TCHAR.H defines these names to be the traditional functions: strcpy, sprintf, and strlen.

Sixth, the program makes no implicit assumptions that a character is eight bits in length. In the _stprintf statement, for

example, I've used %X to format the character code. Normally I probably would have used %02X to format a two-digit hexadecimal code. (However, I had to include the -J flag in the compile command line in UNITYPEA.MAK. This causes the compiler to treat the char data type as an unsigned value rather than signed. Otherwise, when character codes of 0x80 and above are passed to the sprintf function, they are sign-extended and displayed as eight-digit values.)

Otherwise, the program looks fairly normal. During the WM_CHAR message, the character code is delivered in

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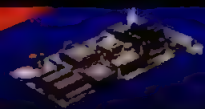
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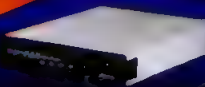


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CIRCLE 370 ON READER SERVICE CARD



UNITYPE.RC

Complete Listing

```
/*-----  
UNITYPE.RC resource script  
-----*/  
  
#include "unitype.h"  
  
UnityType MENU  
{  
    MENUITEM "&Font!",    IDM_FONT  
}
```

Figure 4: This is the resource script that defines the program's menu.

the wParam message parameter. If the window class has been registered using RegisterClassA (as it will be if the UNICODE constant has not been defined), then the low 8 bits of wParam will be the ASCII character code. But if the window class was registered using RegisterClassW, then the low 16 bits of wParam will represent a Unicode character. The UNITYPE program simply casts wParam using the TCHAR data type and saves it for display.

FOREIGN KEYBOARD LAYOUTS Of course, if you have a U.S. keyboard installed, you won't see any of the extra Unicode characters included in the Lucida Sans Unicode font, even with UNITYPEW.EXE. But here's where the fun starts. While UNITYPEW is running, bring up the Control Panel and select International. Bring down the Keyboard Layout combo-box list. You'll see a bunch of other options to your current keyboard layout. Choose Greek, for example, and click OK. The first time you do this, the Control Panel will ask you for the Windows NT CD-ROM so it can load the appropriate keyboard layout file. Then go back to UNITYPEW and—lo and behold—you'll be typing Greek characters from your keyboard. (When playing around with the Greek keyboard layout, you'll probably want to use the mouse for much of your activity within Windows NT, because you won't be able to type Latin characters, only Greek. This means that keyboard accelerators in menus won't work correctly.)

What do you think UNITYPEA displays when the Greek keyboard is installed? The window procedure in UNITYPEA has been registered with the RegisterClassA function, which means

that Windows NT will deliver only eight-bit character codes to the window procedure in the WM_CHAR message. So what does the window procedure get if the character code requires more than eight bits? Well let's check it out: You'll find that whenever you type something that requires a character code above 0xFF, UNITYPEA receives a WM_CHAR message with wParam equal to 0x3F—the ASCII code for a question mark. You'll also see the question marks on an NT command line when the character code is above 0xFF.

You can also install a Russian keyboard layout, which lets you type Cyrillic characters. Many of the other keyboard layouts generate Latin characters and are fairly similar to the U.S. layout as far as arrangement of letters goes. Some layouts, however, have small changes from the U.S. version. The German keyboard, for example, reverses the Z and Y keys.

Many keyboard layouts have facilities for typing accented Latin characters. Try the Finnish keyboard, for example. You'll find that the Left Bracket key results in an upper- or lowercase A with a ring above it. These have character codes of 0xC5 and 0xE5, which are part of the ANSI character set. The Equal sign key now functions as a "dead key," which generates no WM_CHAR message. Follow the Equal sign key with a vowel key to display the letter with an acute or grave accent, depending on whether you had Shift depressed when you typed the Equal sign key. The Right Bracket key is similar, allowing you to type a vowel with a diaeresis (¨) or a circumflex (^). The Comma and Semicolon keys also generate the letters A and O with a diaeresis. These are all characters in the ANSI character set, so you can also see them in UNITYPEA.EXE.

The Hungarian keyboard layout can generate four characters that require the Unicode extensions. The Left Bracket and Backslash keys are mapped to the upper- and lowercase O and U with double acute accents.

So, assuming that the Windows NT user has installed a keyboard layout appropriate for the actual hardware keyboard installed on the machine (that is, generating character codes corresponding to the key caps), you don't have to

worry about how the characters are being generated—all you have to do is get them and use them.

MULTIPLE ALPHABET SUPPORT The existence of the various keyboard layouts that generate Unicode characters is, of course, helpful to users in those countries. But what about, say, an American scholar of Greek literature who wants to use multiple alphabet sets in a Unicode-aware word processor? As we've seen, you can go into the Control Panel and switch keyboard layouts back and forth, though that's hardly the most elegant approach. This is actually a software problem best left to an application that intends to provide multiple alphabet support. Although you can experiment with other keyboard layouts (as we've done), the one you maintain should really correspond to the hardware keyboard you have on your machine, which should also correspond to the primary language you use as well as to the language used in the application. At the very least, the application should use the same alphabet (Latin or non-Latin) as the keyboard. Otherwise, menu keyboard accelerators will not work correctly.

UNICODE AND FILES Another program that can take advantage of Unicode is the UNIPAD program included with the Win32 Software Development Kit and installed in the Win32 SDK Tools program group. This is a version of NOTE-PAD that can save Unicode text to files and read Unicode text files.

The plain ASCII text file has traditionally been useful, because it represents the lowest common denominator of text without any formatting (aside from line breaks and tabs). Before word processors became enhanced with various conversion tools, the plain-text format was necessary for moving text from one word processor to another. Plain text is also used for uploading messages to elec-

UNITYPE.H

Complete Listing

```
/*-----  
UNITYPE.H header file  
-----*/  
  
#define IDM_FONT    1
```

Figure 5: This header file defines an identifier used in both UNITYPE.C and UNITYPE.RC.

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Max. Resolution	1024x768/87Hz	1024x768/60Hz	1024x768/72Hz	1024x768/72Hz	1024x768/72Hz	1280x1024/60Hz
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tronic mail and communications services.

A Unicode plain-text file is similar to an ASCII plain-text file, except that each character occupies 16 bits in the file rather than 8 bits. But how do we differentiate between the two files? After all, a Unicode text file could be interpreted as a series of 8-bit characters, and what a mess that would be. Moreover, because of the difference in byte-ordering implemented in Intel and Motorola processors, programs running on different machines could interpret a string of Unicode characters in different ways. For example, consider the byte string

0x10 0x20 0x30 0x40 0x50 0x60

which is assumed to represent three Unicode characters. A Motorola-based program would interpret this as the Unicode characters 0x1020, 0x3040, and 0x5060, while an Intel-based program would interpret the string as 0x2010, 0x4030, and 0x6050. This would be a problem in moving Unicode text files between Intel and Motorola machines.

For this reason, a special Unicode character of 0xFEFF has been defined as a Byte Order Mark. This character should appear at the beginning of a Unicode text string that may have to be interpreted by another program.

In particular, the Byte Order Mark should appear at the beginning of a Unicode plain text file. When written to a file by an Intel-based program, it appears as the byte string 0xFF, 0xFE, and that's what you will find in a Unicode file that is saved by the UNIPAD program. For a Motorola-based program, the Byte Order Mark will appear as the sequence 0xFE, 0xFF. Thus, by reading the first 2 bytes of a Unicode text file, a program can determine how the remaining character bytes are ordered. For example, a Unicode text file containing just the word Hi (the Unicode characters 0x0048 and 0x0069) will be stored by an Intel-based program as

0xFF 0xFE 0x48 0x00 0x69 0x00

and by a Motorola-based program as

0xFE 0xFF 0x00 0x48 0x00 0x69

0xFFFF (the reverse of the Byte Order Mark) is specifically undefined as a character by the Unicode standard.

Of course, a program not aware of Unicode would simply assume that the first 2 bytes are ASCII character codes. *The Unicode Standard: Worldwide Character Encoding, Version 1.0* (Volume 1, Appendix B) indicates that "the sequence 0xFEFF is exceedingly rare at the outset of regular non-Unicode text files," but unfortunately that doesn't solve the problem of a Unicode-aware program interpreting an ASCII file that actually begins with these 2 bytes!

If you save a Unicode text file from UNIPAD and use the TYPE command on a Windows NT command line to display it, you'll get the ASCII characters of the file separated by spaces. The TYPE command doesn't know anything about Unicode. Not yet, anyway. As I've said, the sheer quantity of programs written for ASCII makes the transition to Unicode quite a job. But it's time to begin. □

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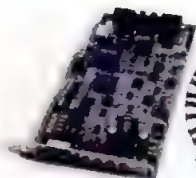
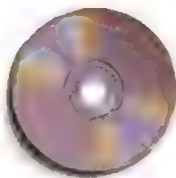


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Utilities

BY NEIL J. RUBENKING

A System Monitor For Windows

Windows lets you multitask your favorite programs, but you can't keep loading more and more programs indefinitely. Eventually you'll fill up all of your system's memory or run out of a special kind of memory called *Free System Resources* (FSRs). Also, running many programs at once causes you to use up hard disk space fast. This issue's utility, MONTOR, tracks your system's memory, FSRs, and hard disk space, and warns you if any one of them gets too low. MONTOR was written in Microsoft Visual Basic and takes advantage of VB's special qualities in order to create a unique graphical interface.

MONTOR is a Windows 3.1 program that relies on the Windows 3.1 Tool Helper library TOOLHELP.DLL and on the Windows 3.1 version of WinHelp. It requires the Visual Basic runtime module VBRUN300.DLL. If this file isn't already present on your system, download the file VBRUN3.ZIP from Library 10 of PC MagNet's TIPS Forum and unzip it into your Windows system directory. The files MONTOR.ZIP and MONSRC.ZIP, both found in the PC MAG UTIL Library, contain the program and its source code. If you just want the program, download the self-extracting archive MONTO.EXE. For details on how to download these files, see the sidebar "Guide to Our Utilities and How to Get Them." To recompile MONTOR, you'll need Visual Basic, Version 3.0.

To install MONTOR, unzip MONTOR.ZIP into a directory on your hard disk, move the file DISKDLL.DLL into your Windows system directory, and then

create a Program Manager icon for MONTOR. You may want to run MONTOR automatically every time Windows starts; if so, drag its icon into your Startup group.

To remove MONTOR from your system, first delete its icon from Program Manager. Then delete MONTOR.EXE, MONTOR.HLP, DISKDLL.DLL, and MONTOR.INI (a file that MONTOR created in your Windows directory). Make sure you don't delete VBRUN300.DLL, as you're likely to need it for other programs.

USING MONTOR When you click on its icon, MONTOR will display from five to eight gauges that register the free percentage of various system resources (Figure 1). The first three gauges correspond to three FSR values: System, graphics device interface (GDI), and User (more about these in a moment). The fourth gauge tracks available memory, including virtual memory created by using a Windows swap file. The remaining gauges monitor up to four fixed disks—hard disks, hard disk partitions, or RAM disks. If the system has fewer than four fixed disks, MONTOR's main window shrinks to omit the extra gauges.

FSRs are the bottleneck in Windows memory management. You may have many megabytes of free memory, but if you run out of FSRs, Windows can't load any more programs. In Windows 3.0, the FSRs were drawn from two chunks of memory—one in Windows' GDI library and one in the USER library—each with

a maximum size of 64K. In Windows 3.1, both GDI and USER provide multiple 64K chunks of memory for FSRs, but they're still a bottleneck.

The System FSR percentage is simply the smaller of the GDI and User percentages. Every graphical element on the screen uses a little bit of the GDI resources; menus and other program elements take space in USER's resources.

As Figure 1 shows, each gauge consists of eight elements arranged vertically. The Resource label at the top identifies which resource this gauge is tracking, and the Max Value label displays the maximum value for this resource. This label is omitted from the three FSR gauges, since Windows reports FSR values as percentages. Immediately below each gauge is a label showing the free amount of the resource, again omitted from the three FSR gauges. The Percent Free label on the next line displays the percentage of the resource that's free, and the Warn At label displays the value at which MONTOR will issue a warning.

The gauge itself is a vertical line marked off in increments of 10 percent. To the left of the line is a yellow current-



Figure 1: MONTOR displays how much of your Windows resources are free and warns you if they drop too low.

value pointer that graphically represents the value shown in the Free Percent label. The red warning-level pointer to the right of the line directly corresponds to the percentage in the Warn At label.

MONTOR initially sets the warning levels by reading values from the file MONTOR.INI. If this file does not yet exist, MONTOR sets them to a default value of 20 percent. To set a level yourself, just grab the pointer with the mouse

and drag it to the desired location. The pointer is difficult to drop at precisely the percentage you want, so you can fine-tune the warning level by clicking directly on the vertical gauge line. Click above the pointer to raise it 1 percent or below to lower it 1 percent. To set a warning level using the keyboard, press the Tab key repeatedly until the Warn At label for the particular gauge is highlighted. (Alternatively, you can click on the Warn At label with the mouse.) Now move the warning-level pointer up and down by 1 percent using the Up Arrow and Down Arrow keys or by 5 percent using the PgUp and PgDn keys.

Even when minimized to an icon, MONTOR continues to watch your system's resources. In the iconic state, MONTOR can display the free percentage for only one of the gauges. Click on the heading at the top of a gauge to select it for display in the iconic state.

When any one of the resources tracked by MONTOR dips below the warning level, MONTOR will beep and display a dialog box. If you have configured your Windows system to use sound for system events, you'll hear the sound you selected for Critical Stop. You can press OK to close the dialog box or Help to learn more from MONTOR's help system about what happened.

MONTOR'S MENUS Since MONTOR doesn't manipulate files, its File menu contains the single item Exit. The Options menu lets you control two program options by placing or removing a check mark next to menu items. When the item Jiggle Pointers is checked, the yellow current-value pointers will jiggle slightly up and down at random, and the circles at the left of the display will exchange colors. This behavior has no practical value, but it makes the display more interesting. The Save Settings on Exit menu item causes MONTOR to save the warning levels and option information to MONTOR.INI when you exit MONTOR. In general, you should leave the Save Settings on Exit menu item checked.

Selecting a resource name from the Icon Display menu has the same effect as clicking on the corresponding gauge heading—that resource is displayed when MONTOR is minimized to an icon.

Just clicking on the heading is easier, unless you're operating MONTOR on a mouseless system.

The Help menu gives you instant access to MONTOR's help system—you can call up the contents page, the search dialog, or the standard help file on how to use help. Like the rest of MONTOR, the help system is visually oriented. Its Contents page contains a partial picture of the MONTOR display, and you simply click on a display element to learn about that part. You can also press the Tab key to cycle through the display elements and the Enter key to get help on the highlighted element.

PROGRAMMING MONTOR MONTOR's interface displays up to eight gauges, each consisting of eight separate controls. This structure lends itself admirably to Visual Basic's *control array* concept. Each control in a control array has its own distinct set of properties, but they all share the same method code. An Index parameter added to each method identifies the active element of the control array. If you program in C++ or Borland Pascal, you may notice a certain similarity between control arrays and objects, because multiple instances of an object class have individual data members but share the same function members.

For each gauge, MONTOR has to store several pieces of information, such as the Maximum and Warn At values, for the resource tracked by that gauge. MONTOR *could* use simple data arrays to hold this information, but Visual Basic provides a convenient alternative. Almost every Visual Basic control has a field called Tag that can hold string or numeric data. Visual Basic doesn't use this field; it's provided for the programmer's convenience. As you will see below, MONTOR uses Tag fields in order to

store the data for each gauge.

MONTOR relies on a number of Windows application programming interface (API) functions that aren't included in Visual Basic. The module file MONTOR.BAS contains declarations for these functions, related constants, and a handful of global variables.

To identify the fixed disks on your system, MONTOR checks whether the value returned by the GetDriveType() function is DRIVE_FIXED. The function MemManInfo() returns memory manager information for calculating maximum memory, and GetFreeSpace() returns the total amount of free memory. To get the FSR percentages, MONTOR calls the SystemHeapInfo() function which, like MemManInfo(), resides in Windows's TOOLHELP library.

MONTOR uses the GetPrivateProfileInt() function to read numeric configuration data from MONTOR.INI. Oddly enough, there's no WritePrivateProfileInt() function in the Windows API, so MONTOR uses WritePrivateProfileString() to write the configuration data back to the .INI file. The WinHelp() function activates Windows' built-in help system; WinHelpByNum() is an alternative form of the same function. Finally, the Windows API function MessageBeep() uses Windows 3.1's sound support to play the .WAV sound file associated with a particular system event.

The last two declarations in MONTOR.BAS aren't Windows API

DISKDLL.PAS

Complete Listing

```
LIBRARY DiskDll;
USES WinDos;
{$D Copyright (c) 1993 by Neil J. Rubenking}

FUNCTION GetDiskSize(Drive : Word) : LongInt; Export;
BEGIN
  GetDiskSize := DiskSize(Drive);
END;

FUNCTION GetDiskFree(Drive : Word) : LongInt; Export;
BEGIN
  GetDiskFree := DiskFree(Drive);
END;

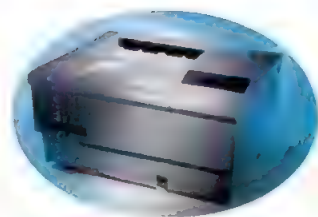
EXPORTS
  GetDiskSize INDEX 1,
  GetDiskFree INDEX 2;
BEGIN
END.
```



Figure 2: This tiny DLL, written in Borland Pascal for Windows, lets MONTOR determine the capacity and amount of free space for any disk.

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functions at all. Neither Visual Basic nor Windows provides functions to determine the capacity and free space of a disk, so I implemented them in a tiny dynamic link library (DLL) written in Borland Pascal for Windows (Figure 2). You don't need Borland Pascal to compile or run MONTOR; the DLL is self-contained.

SETTING UP RESOURCE TRACKING The Load method of MONTOR's main form sets up all the gauges, and the Timer method of its Timer control tracks their current values. At the start, the Load method (shown in Figure 3) checks whether MONTOR is already running. If a previous copy is found, the Load method activates it and quits. This is done because MONTOR consumes a fair amount of FSRs itself—as much as 10 percent—so it doesn't make sense to run multiple copies. A professional version of MONTOR written in C++ or Borland Pascal might reduce its use of system resources by eliminating almost all the on-screen controls and instead have the main window handle all screen painting and user input.

Next, the Load method tries to locate up to four fixed disks. It checks the drive

type of each drive number starting with 0, which corresponds to drive A:. If the type is DRIVE_FIXED, the Load method initializes a gauge, adds the drive's name to the Icon Display menu, and adds 1 to the variable ActualGauges. Like GetDriveType(), the functions GetDiskSize() and GetDiskFree() take a drive number as their parameter. For the DOS routines underlying these two functions, 1 represents drive A:, 2 represents drive B:, and so on. The appropriate number is stored in the Tag field of the gauge's heading label. The loop continues until it either reaches drive Z: or fills up the four gauges. (The NumGauges constant is the maximum number of gauges that MONTOR can accommodate.) After determining the number of drives, the Load method adjusts the form's width so that unused gauges don't show.

The Load method then calls the function LoadFromIni() (Figure 4) to retrieve the warning levels and the values for the Option menu items. If the .INI file doesn't yet exist, the default value for each warning level is 20 percent. The default resource to display when iconized

is 0 (System FSRs), and both Option menu items default to TRUE. The corresponding function SaveToIni() writes the current values back to the .INI file when you exit MONTOR.

MONTOR's gauges and its current value and warning-level pointers are bitmaps associated with Visual Basic Picture boxes and Image controls. When the association is made at design time, the bitmaps are incorporated into the final .EXE file. If you associate the same bitmap with more than one control at design time, you'll get multiple copies of that bitmap in the .EXE. MONTOR avoids this unnecessary program bloat by associating bitmaps with only the first gauge, current-level pointer, and warning-level pointer. Then at runtime, the Load method copies the picture property of these controls to the similar controls (up to seven), along with the DragIcon for the warning-level pointer.

The call to PlaceWarnPtr() (Figure 5) moves a warning-level pointer into place, assigns the warning label, and sets the Tag field of the warning label to FALSE. (A little later I'll discuss the details of how the warning-level pointer is moved.)

Form_Load()

Complete Listing

```
Sub Form_Load ()
' If a previous instance is running, activate it instead
Dim SaveTitle As String * 48
If App.PrevInstance Then
SaveTitle$ = App.Title
App.Title = "... duplicate instance."
Form1.Caption = "... duplicate instance."
AppActivate SaveTitle$
SendKeys "% R", True
End
End If

' Initialize two variables used in calculating pointer positions.
' Gauge line starts and ends 7 pixels from top/bottom of bitmap.
TopAdj = 7 * Screen.TwipsPerPixelY
GHeight = 288 * Screen.TwipsPerPixelY

' Include gauges for up to four fixed disks. Use GetDriveType to
' check each possible drive letter - only monitor those whose type
' is DRIVE_FIXED
ActualGauges = 4
Dim N%, Disk As String * 2
N = 0
Do While (N < 26) And (ActualGauges < NumGauges)
If GetDriveType(N) = DRIVE_FIXED Then
GaugeMain(ActualGauges).TabStop = True
Disk = Chr$(N + 65) + ":"
HeadingLab(ActualGauges).Caption = "Drive " + Disk
' Tag for HeadingLab is disk NUMBER for disk size functions
HeadingLab(ActualGauges).Tag = N + 1
Load Form1.mnu_Icon(ActualGauges)
Form1.mnu_Icon(ActualGauges).Caption = "Drive &" + Disk
Form1.mnu_Icon(ActualGauges).Visible = True
Form1.mnu_Icon(ActualGauges).HelpContextID = 3
ActualGauges = ActualGauges + 1
End If
N = N + 1
Loop
' Shrink the form to chop off any unused drive gauges
Width = GaugeMain(ActualGauges - 1).Left

Width = Width + GaugeMain(ActualGauges - 1).Width
Width = Width + (16 * Screen.TwipsPerPixelX)

LoadFromIni
Randomize

' To save EXE size, we store each picture ONCE in the EXE and
' copy it to the other elements of the same control array.
Dim X%
X = GaugeMain(0).Width - WarnLevPtr(0).Width
For N = 0 To ActualGauges - 1
CurrValPtr(N).Picture = CurrValPtr(0).Picture
WarnLevPtr(N).Picture = WarnLevPtr(0).Picture
WarnLevPtr(N).DragIcon = WarnLevPtr(0).DragIcon
GaugeMain(N).Picture = GaugeMain(0).Picture
PlaceWarnPtr N
Next N

' Get the total system memory
Dim mmi As tagMemManInfo
mmi.Size = MMISize
Dim Success%
Success = MemManInfo(mmi)
GaugeMain(3).Tag = mmi.TotalPages + mmi.SwapFilePages
GaugeMain(3).Tag = GaugeMain(3).Tag * mmi.PageSize
MaxValueLab(3).Caption = MegaOrKilo(GaugeMain(3).Tag)

' Get the size of each fixed drive
For N = 4 To ActualGauges - 1
GaugeMain(N).Tag = GetDiskSize(HeadingLab(N).Tag)
MaxValueLab(N).Caption = MegaOrKilo(GaugeMain(N).Tag)
Next N

' Set left and right boundaries of the area on each gauge that will
' be accepted as a click on the gauge's vertical line.
LineL = GaugeMain(0).Width \ 2 - 60
LineR = LineL + 120
End Sub
```

Figure 3: The Load method of MONTOR's main form performs a variety of set-up tasks for the program.

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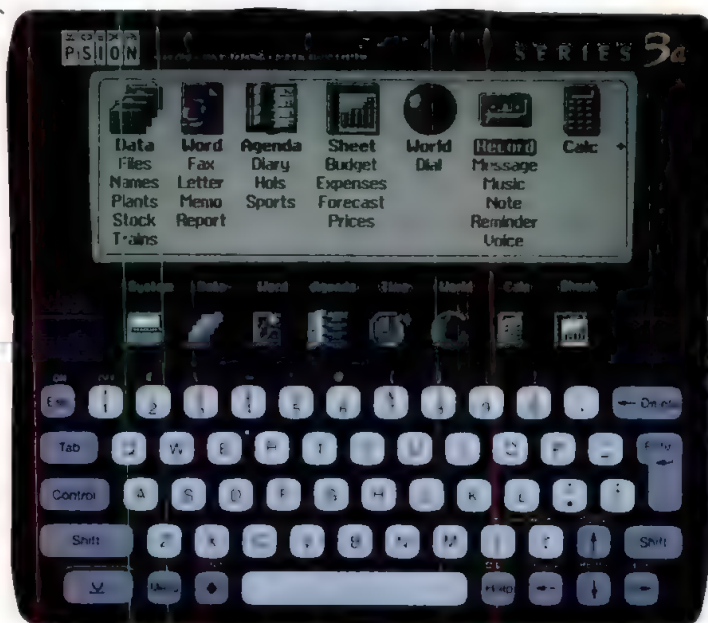
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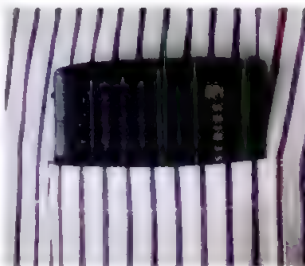
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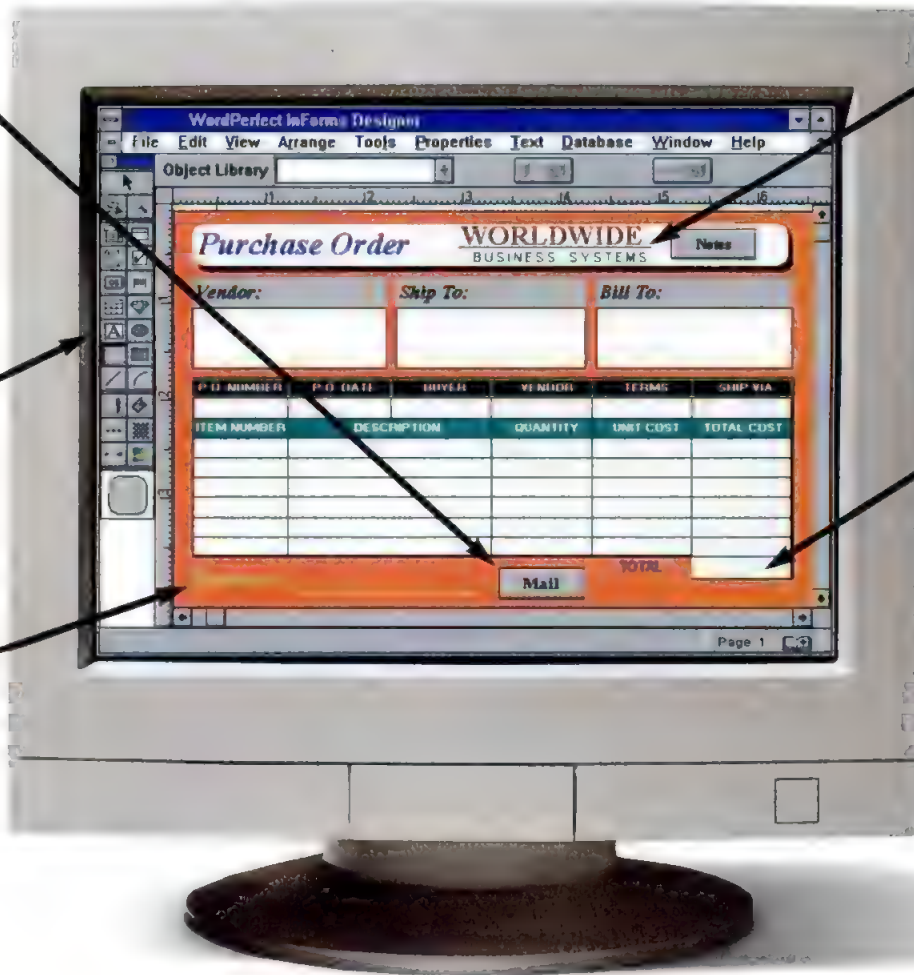
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WordPerfect INFORMS

LoadFromIni() and SaveToIni()

Complete Listing

```
Sub LoadFromIni ()
' Load program options from MONTOR.INI
mnu_Options(0).Checked = GetPrivateProfileInt("Options",
"Jiggle Pointers", True, "MONTOR.INI")
mnu_Options(1).Checked = GetPrivateProfileInt("Options",
"Save Settings", True, "MONTOR.INI")
Dim IconRpt%
IconRpt = GetPrivateProfileInt("Icon Display", "Icon", 0, "MONTOR.INI")
SelectIconReport (IconRpt)
' Get warning level for each gauge, or default of 20%
Dim N%
For N = 0 To ActualGauges - 1
WarnLevPtr(N).Tag = GetPrivateProfileInt("Warning Levels",
"Gauge" + Str$(N), 20, "MONTOR.INI")
Next N
End Sub

Sub SaveToIni ()
' Write Save Settings option to MONTOR.INI; write the rest of the
```

```
' options only if Save Settings is TRUE
Dim Success%
Success% = WritePrivateProfileString("Options", "Save Settings",
mnu_Options(1).Checked, "MONTOR.INI")
If mnu_Options(1).Checked Then
Success% = WritePrivateProfileString("Options", "Jiggle Pointers",
mnu_Options(0).Checked, "MONTOR.INI")
Success% = WritePrivateProfileString("Icon Display", "Icon",
Str$(WhichIcon), "MONTOR.INI")
Dim N%
For N = 0 To ActualGauges - 1
Success% = WritePrivateProfileString("Warning Levels",
"Gauge" + Str$(N), WarnLevPtr(N).Tag, "MONTOR.INI")
Next N
End If
End Sub
```



Figure 4: MONTOR stores warning-level information and menu-item status in the file MONTOR.INI; these functions read and write that information.

MONTOR uses the warning label's Tag field to avoid repeating its warning unnecessarily. When issuing a warning, it sets this Tag to TRUE and won't issue another warning for the same resource until the Tag is FALSE again. The Tag gets set to FALSE when the resource comes up above the warning level or when the user changes the warning level.

Next, the Load method calculates the maximum value for the Memory gauge and Drive gauges. The Windows API function MemManInfo() fills a user-defined data structure with information about memory. To get the total available memory, the Load method adds the number of actual memory pages to the number of pages in the swap file and multiplies this subtotal by the page size. It stores the result in the Tag field of the Memory gauge and calls the user-defined function MegaOrKilo() to convert the result to kilobytes or megabytes for display in the Max Value label. The Load method then calls GetDiskSize() to get each drive's capacity, stores the result in the gauge's Tag field, and converts it for display using MegaOrKilo().

RESOURCE TRACKING BY THE CLOCK

About every 2 seconds, Windows calls the Timer method of MONTOR's Timer control (Figure 6). This method checks the value of each resource, adjusts the display, jiggles the pointers, and displays a warning if any resource has dropped below its warning level. It also displays the free percentage of the selected resource when MONTOR is iconized.

The Timer method calls the Windows API function SystemHeapInfo() to get

the FSR percentages for GDI and User, and assigns the smaller of the two to System. It then calls GetFreeSpace() to get the amount of free memory, and calls GetDiskFree() for each fixed disk to get the amount of free disk space. For both memory and fixed disk space, the Timer method sets the Free label to the obtained value after converting it for display with MegaOrKilo().

Now the Timer calculates the free percentage of each resource, dividing the amount of free resources (stored in the current-value pointer's Tag) by the maximum value (stored in the GaugeMain picture box control's Tag). It uses the resulting value to adjust the position of the current-value pointer and displays the percentage in the gauge's Percent label.

At this point, if you've chosen to make the display lively by selecting the Jiggle Pointers menu option, the Timer method exchanges the colors of the two circles at

the left of the display. Then it uses the Rnd() function to make random changes in the position of each pointer. Twenty percent of the time the Timer method will tweak the pointer down, 20 percent of the time it will tweak it up, and 60 percent of the time it will leave the pointer alone.

For each gauge, the Timer method checks whether the percentage of free resources has dropped below the warning level. If so, it checks the Tag of the corresponding warning label to see if it has already warned about this problem. The actual warning is transmitted using a secondary Visual Basic form: Form3. The Timer method sets the global variable WnTx to an explanatory string for display in the warning form. It also sets the global variable WarnHelp to the portion of the help file (the "help context") corresponding to the resource that has run out.

Before activating Form3, the Timer method passes the value MB_ICON

PlaceWarnPtr()

Complete Listing

```
Sub PlaceWarnPtr (ByVal Index%)
' The warning level pointer's tag contains the new percent - now
' adjust the labels and place the pointer to match that percent.
' Adjust the Warn At caption
WarnLabel(Index).Caption = Str$(WarnLevPtr(Index).Tag) + "%"
' The gauge is exactly 200 pixels high
Dim NewY%
' Set NewY to the *pixel* height corresponding to the percentage
NewY = ((98 - WarnLevPtr(Index).Tag) * 2) - 1
' Convert NewY to twips (VB's unit of screen measurement)
NewY = NewY * Screen.TwipsPerPixelY
' Adjust to start at the top of the gauge line
NewY = NewY + TopAdj
WarnLevPtr(Index).Move WarnLevPtr(Index).Left, NewY
WarnLabel(Index).Tag = False
End Sub
```

Figure 5: Routines within MONTOR call PlaceWarnPtr() to position the warning-level pointer on the gauge.



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STOP to the Windows API function `MessageBeep()`. If you've used the Windows Control Panel to attach sounds to system events, this action will generate whatever sound is associated with Critical Stop; otherwise, it will just beep the speaker. The `Show` method, which comes next, activates `Form3`. `MODAL`, a constant that appears after `Form3.Show`, forces the user to close `Form3` before continuing with the program. Both `MODAL` and `MB_ICONSTOP` are defined in the file `CONSTANTS.TXT`, which comes with Visual Basic.

`Form3`, the warning form, is very simple; it has only three methods. The `Load` method assigns the warning text, which is stored in the global variable `WnTx`, to

`Label2`'s caption. The other two methods handle button clicks. Clicking the OK button hides the form, and clicking the Help button calls `WinHelp`, passing it the help context contained in the global variable `WarnHelp`.

SETTING THE WARNING LEVEL `MONITOR`'s red warning-level pointers provide a visual means for setting the warning levels, rather than forcing users to type numbers. Visual Basic's built-in support for drag-and-drop makes this sophisticated feature easy to implement. All it took to make the red warning-level pointers draggable was to set their `DragMode` property to 1 (for Automatic).

A VB control's `DragIcon` property defines its appearance while being dragged.

If this property doesn't exist, the control appears as a rectangular outline. An icon intended for use as a `DragIcon` can use only four colors: black, white, inverted, and transparent. Transparent portions of the icon let the underlying screen show through, while inverted portions invert the color of the underlying screen. The `DragIcon` for `MONITOR`'s warning-level pointers looks like the standard mouse-cursor arrow pointing to an inverted outline of the pointer itself. Note that VB's handling of `DragIcons` is incompatible with certain 15-bit video drivers, also called 32K color drivers. When you drag `MONITOR`'s pointers while using such a driver, you'll see garbage instead of the correct `DragIcon`.

Timer1_Timer()

Complete Listing

```
Sub Timer1_Timer ()
' This method is called about every two seconds - it updates all of
' the gauges and warns if any have dropped below the minimum. If
' MONITOR is iconic, it redraws the icon.

' Set current values for the system resource gauges
Dim shi As TagSysHeapInfo
shi.Size = SHISize
Dim Success%
Success = SystemHeapInfo(shi)
CurrValPtr(2).Tag = shi.UserFreePercent
CurrValPtr(1).Tag = shi.GDIFreePercent
If shi.UserFreePercent < shi.GDIFreePercent Then
    CurrValPtr(0).Tag = shi.UserFreePercent
Else
    CurrValPtr(0).Tag = shi.GDIFreePercent
End If

' Set and display current value for the memory gauge
CurrValPtr(3).Tag = GetFreeSpace(0)
CurrValLab(3).Caption = MegaOrKilo(CurrValPtr(3).Tag)
' Set and display current value for disk space gauges
Dim N%
For N = 4 To ActualGauges - 1
    CurrValPtr(N).Tag = GetDiskFree(HeadingLab(N).Tag)
    CurrValLab(N).Caption = MegaOrKilo(CurrValPtr(N).Tag)
Next N

' Redisplay the pointers
Dim Locat!, Percent!
Dim NewCVY%
For N = 0 To ActualGauges - 1
    ' Calculate the current percentage
    NewCVY = (100 * CurrValPtr(N).Tag) / GaugeMain(N).Tag
    PercentLab(N).Caption = Str$(NewCVY) & "%"
    NewCVY = ((98 - NewCVY) * 2) - 1
    NewCVY = NewCVY * Screen.TwipsPerPixelX
    NewCVY = NewCVY + TopAdj
    CurrValPtr(N).Move 0, NewCVY
Next N

' If the "Jiggle Pointers" option is checked...
If mnu_Options(0).Checked Then
    ' Blink the "pulse" circles
    Dim TempCol%
    TempCol = Circ(0).BackColor
    Circ(0).BackColor = Circ(1).BackColor
    Circ(1).BackColor = TempCol
    ' Jiggle the pointers
    Dim NewY%
    For N = 0 To ActualGauges - 1
        Select Case Rnd
            Case 0 To .2
                NewY = CurrValPtr(N).Top + Screen.TwipsPerPixelX
                CurrValPtr(N).Move CurrValPtr(N).Left, NewY
            Case .2 To .4
                NewY = CurrValPtr(N).Top - Screen.TwipsPerPixelX
                CurrValPtr(N).Move CurrValPtr(N).Left, NewY
        End Select
    Next N
End If

' Check if any warnings are necessary
For N = 0 To ActualGauges - 1
    Percent = (CurrValPtr(N).Tag * 100) / GaugeMain(N).Tag
```

```
If Percent < WarnLevPtr(N).Tag Then
    If Not WarnLabel(N).Tag Then
        Select Case N
            Case 0 To 2
                ' Normally you would assign WnTx's value using one long
                ' program line. Here it's built up gradually, so as to
                ' make it easier to publish the source code.
                WnTx = "Free " + HeadingLab(N).Caption + " resources have"
                WnTx = WnTx + " dropped below" + Str$(WarnLevPtr(N).Tag)
                WnTx = WnTx + "%." + Chr$(13) + Chr$(13) + "Even if you "
                WnTx = WnTx + "have plenty of memory free, you will not "
                WnTx = WnTx + "be able to run many more programs. "
                WnTx = WnTx + "Consider closing one or more programs."
                WarnHelp = 1
            Case 3
                WnTx = "Free memory has dropped below"
                WnTx = WnTx + Str$(WarnLevPtr(N).Tag) + "%." + Chr$(13)
                WnTx = WnTx + Chr$(13) + "Consider closing one or more "
                WnTx = WnTx + "programs."
                WarnHelp = 2
            Case 4 To ActualGauges
                WnTx = "Free disk space on " + HeadingLab(N) + " has "
                WnTx = WnTx + "dropped below" + Str$(WarnLevPtr(N).Tag)
                WnTx = WnTx + "%." + Chr$(13) + Chr$(13) + "Consider "
                WnTx = WnTx + "using File Manager to delete any files "
                WnTx = WnTx + "that are no longer needed."
                WarnHelp = 3
        End Select
        MessageBeep MB_ICONSTOP
        Form3.Show MODAL
        Unload Form3
        WarnLabel(N).Tag = True
    End If
Else
    WarnLabel(N).Tag = False
End If
Next N

' If MONITOR is iconic, draw the icon
If WindowState = 1 Then
    ' fill whole area with black
    Line (0, 0)-(ScaleWidth, ScaleHeight), 0, BF
    ' draw gauge-line near right side
    Line (ScaleWidth - 60, 0)-(ScaleWidth - 60, ScaleHeight)
    ' set location for writing percent value
    CurrentX = 2 * Screen.TwipsPerPixelX
    Percent = (CurrValPtr(WhichIcon).Tag) / GaugeMain(WhichIcon).Tag
    ' Set Y position to avoid printing on light/dark boundary
    If Percent < .5 Then
        CurrentY = Screen.TwipsPerPixelY
    Else
        CurrentY = ScaleHeight \ 2
    End If
    Print PercentLab(WhichIcon).Caption
    ' XOR the portion corresponding to free percentage
    DrawMode = 7
    Dim Y!
    Y = (1 - Percent) * (ScaleHeight) - (2 * TopAdj)
    Line (0, Y)-(ScaleWidth, ScaleHeight), &HFFFFFF, BF
    DrawMode = 13
End If
End Sub
```



Figure 6: Every two seconds, the `Timer` control's `Timer` method repositions the current-value pointers and displays any warnings that are required.



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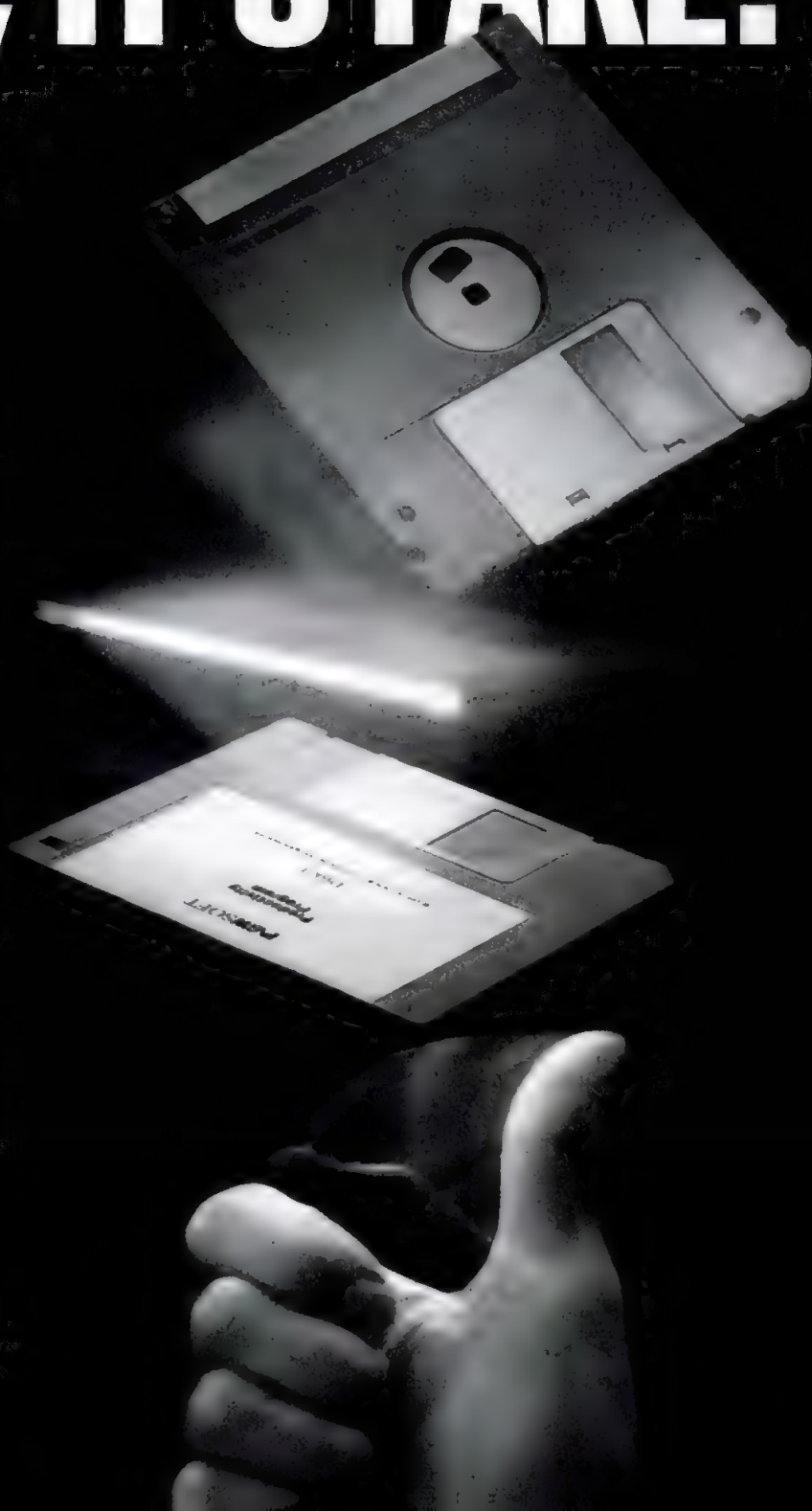
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GaugeMain_DragDrop

Complete Listing

```
Sub GaugeMain_DragDrop (Index As Integer, Source As Control,
X As Single, Y As Single)
' Don't allow dropping onto a different gauge!
If Source.Index <> Index Then Exit Sub
' Adjust position to stay within 0-100%
If Y > TopAdj + GHeight Then Y = TopAdj + GHeight
If Y < TopAdj Then Y = TopAdj
' Calculate new percent based on new position
Source.Tag = (TopAdj + GHeight - Y) * 100 \ GHeight
' Place the pointer and adjust the labels
PlaceWarnPtr Index
End Sub
```



Figure 7: When you drag a warning-level pointer to a new position, this method is invoked to make all necessary adjustments.

The drag part of drag-and-drop for a control is enabled by setting the DragMode and DragIcon properties of the control. What happens when you drop the control is determined by its DragDrop method. The DragDrop method of the GaugeMain control array (Figure 7) is called when the user drops a warning-level pointer onto one of the gauges.

The DragDrop method receives four arguments: an *index* that identifies which gauge is involved, a *source* that provides access to the control being dropped, and the *x* and *y* coordinates at which the control was dropped. The warning-level pointers are the only draggable controls in MONTOR, so this method safely assumes that the Source parameter refers to one of them. The first step of the DragDrop method is to make sure the Index of the Source control matches the Index of the control on which it was dropped. It doesn't make sense to drop the System gauge's pointer onto the Memory gauge! The yellow gauge line doesn't extend the full height of the GaugeMain control, so the DragDrop method adjusts the *y* coordinate to fall within the range of the gauge line. Then it calculates the new warning level based on the drop location and stores it in the warning-level pointer's Tag field.

Dragging a warning-level pointer doesn't actually move the pointer; it only moves its DragIcon image. So the last task of the DragDrop method is to call the function PlaceWarnPtr(). The *x* coordinate will always be the same. The *y* value is first set to the pixel height corresponding to the percentage, then converted to twips (twentieth of a point), and

then adjusted to start at the actual top of the gauge. After the new *y* value is found, the warning-level pointer is moved to the new coordinates.

It's hard to drop the pointer at exactly the percentage you want; each percent corresponds to just 1 pixel! Several other

methods of the GaugeMain picture-box control help with fine-tuning (Figure 8). If the MouseUp method's *x* coordinate is right on the gauge line, this method adjusts the warning-level pointer's position by 1 percent. If the mouse's *y* position is above the pointer, it raises the pointer by 1 percent; if the *y* position is below the pointer, the method lowers the pointer. The actual moving of the pointer takes place in the ChangeWarn() procedure. ChangeWarn() adds the specified change value to the percent stored in the pointer's Tag field and adjusts the result to stay in the range 0 to 100. Then it calls PlaceWarnPtr() to position the pointer at the new value.

You can also set or fine-tune the warning levels using the keyboard. Following the Windows standard, MONTOR lets you move between controls using the Tab key. When you tab to one of the GaugeMain picture-box controls, its GotFocus

GaugeMain Methods

Complete Listing

```
Sub GaugeMain_MouseUp (Index As Integer, Button As Integer,
Shift As Integer, X As Single, Y As Single)
' If the user clicked on the line in the middle of the gauge...
If (X >= LineL) And (X <= LineR) Then
' If they clicked above warning pointer, raise it, else lower it
Dim Locat!
Locat = (TopAdj + GHeight - Y) * 100 \ GHeight
If Locat > WarnLevPtr(Index).Tag Then
ChangeWarn Index, 1
Else
ChangeWarn Index, -1
End If
End If
End Sub

Sub GaugeMain_GotFocus (Index As Integer)
' Indicate the selected gauge by highlighting its warn label
WarnLabel(Index).BackColor = &H808080
End Sub

Sub GaugeMain_LostFocus (Index As Integer)
' Indicate the unselected gauge by unhighlighting its warn label
WarnLabel(Index).BackColor = 0
End Sub

Sub GaugeMain_KeyUp (Index As Integer, KeyCode As Integer, Shift As Integer)
' When it receives an up or downarrow, the Picture Box tweaks
' the warning level up or down by one percent. When
' it receives PgUp or PgDn, it tweaks the level by five percent
Select Case KeyCode
Case KEY_UP
ChangeWarn ActiveControl.Index, 1
Case KEY_DOWN
ChangeWarn ActiveControl.Index, -1
Case KEY_PRIOR ' PgUp
ChangeWarn ActiveControl.Index, 5
Case KEY_NEXT ' PgDn
ChangeWarn ActiveControl.Index, -5
End Select
End Sub
```



Figure 8: These GaugeMain control array methods let you fine-tune the warning-level settings using either the mouse or the keyboard.

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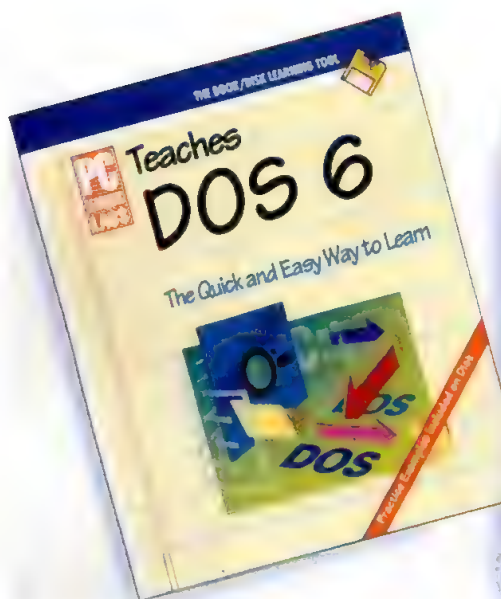
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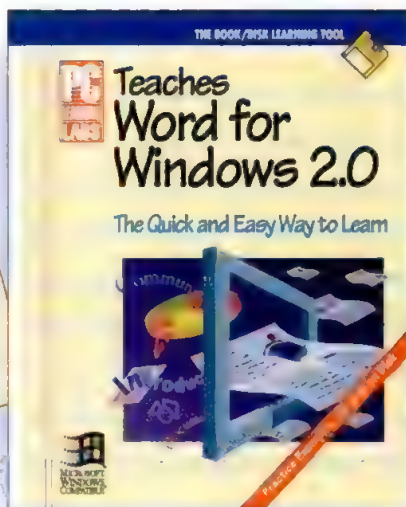
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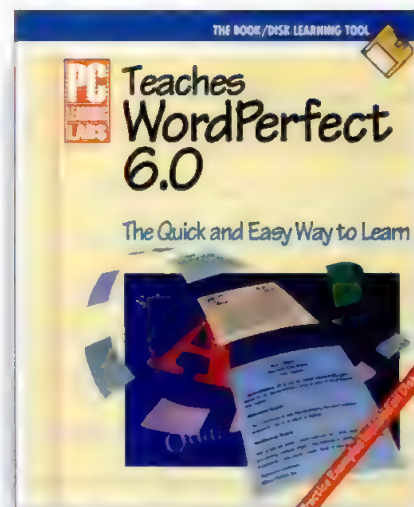
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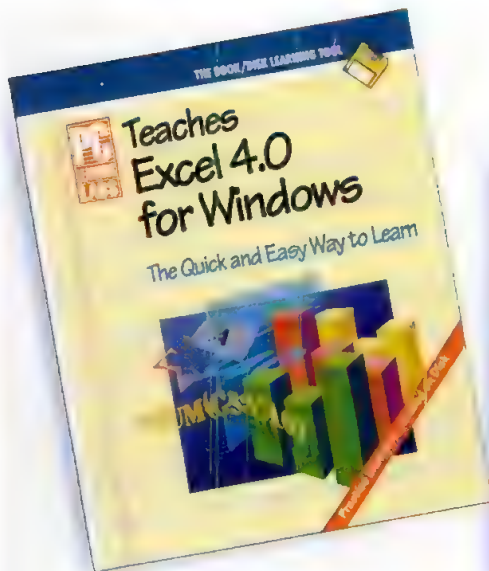
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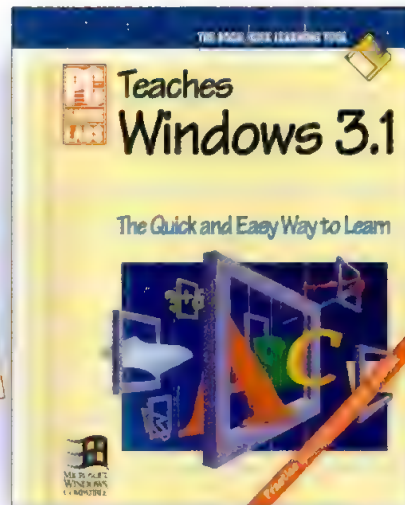
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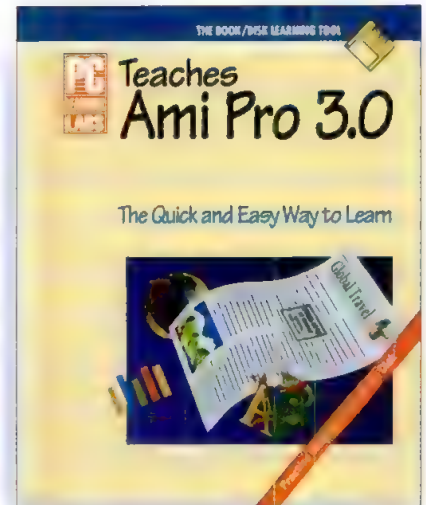
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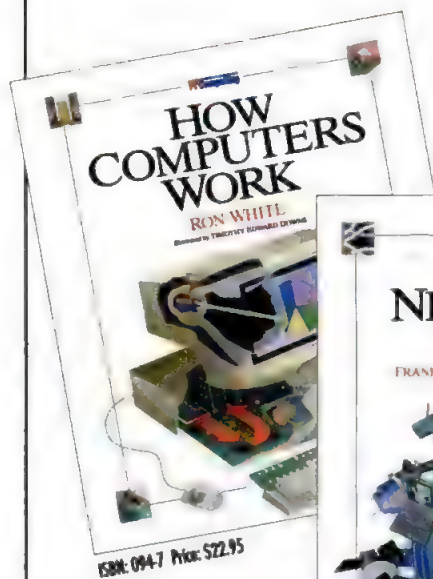
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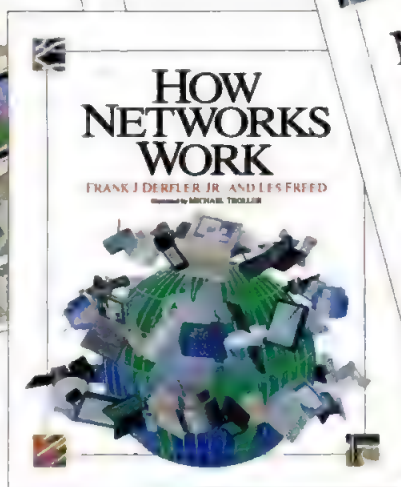
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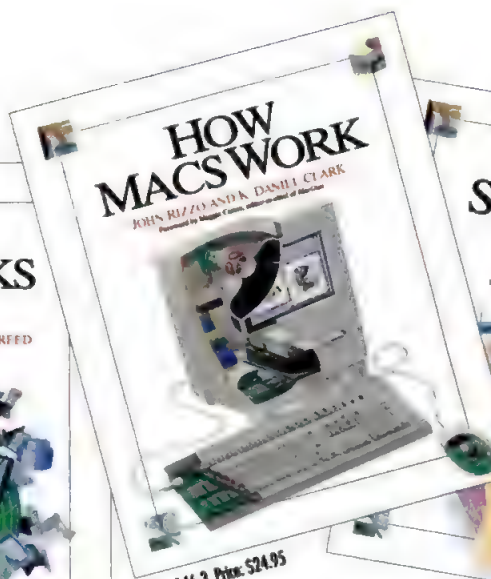
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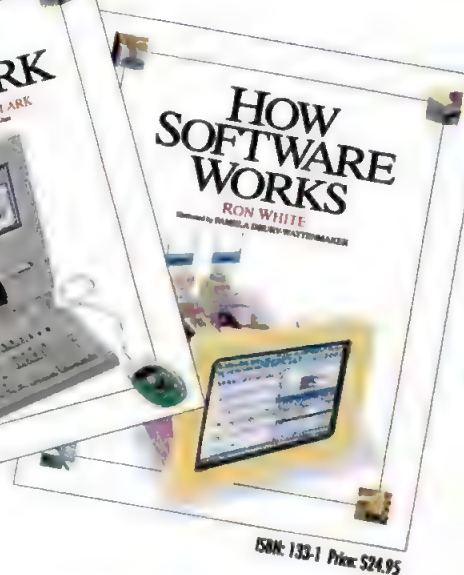
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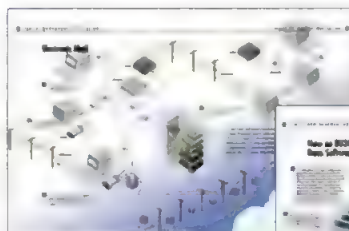
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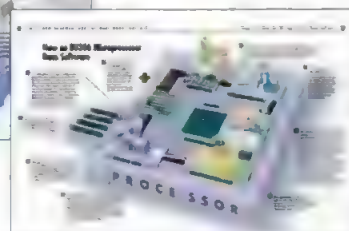
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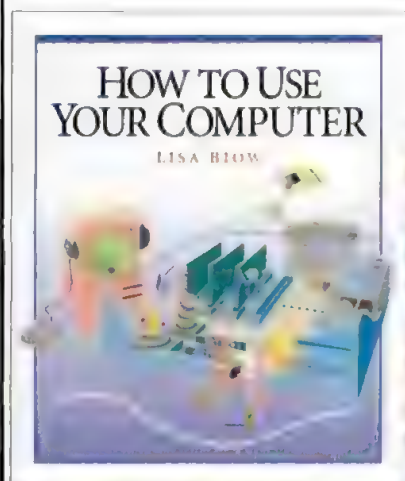
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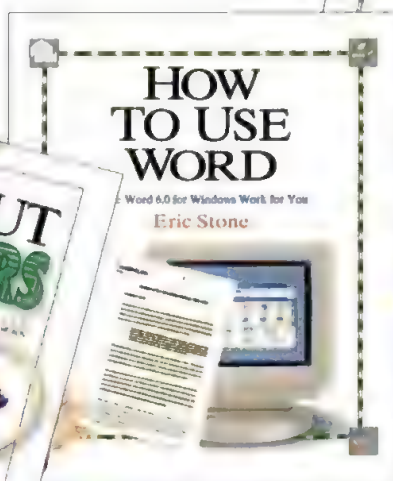
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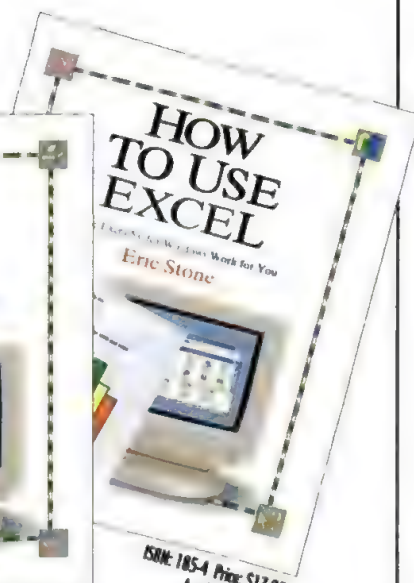
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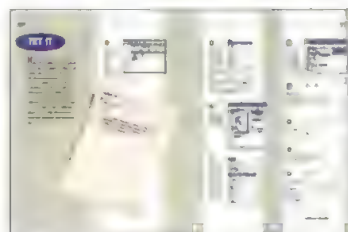
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method highlights the corresponding warning label. Similarly, when you tab off a warning label, the control's LostFocus method removes the highlight. The KeyUp method for the gauge that has the focus responds to the Up Arrow and Down Arrow Keys by using the ChangeWarn() procedure to adjust the warning level by 1 percent. It responds to the PgUp and PgDn keys by adjusting

the level up or down 5 percent. Thus, despite MONTOR's highly visual interface, it can be used without a mouse.

MONTOR makes use of Visual Basic's features, but it also shares in VB's disadvantages. Not only does it use a lot of system resources, the processing it performs every 2 seconds is relatively slow compared with that of a program written in C++ or Borland Pascal. However, the

Visual Basic version of MONTOR is fully functional and demonstrates some interesting programming techniques. In fact, if you do run out of FSRs while using MONTOR, you can always get some breathing room by temporarily deactivating MONTOR itself! □

NEIL J. RUBENKING IS TECHNICAL EDITOR OF PC MAGAZINE.

GUIDE TO OUR UTILITIES & HOW TO GET THEM

MONTOR

PURPOSE: MONTOR tracks your system's available memory, free system resources, and disk space, and warns you if any one of them drops below preset warning points. MONTOR uses Windows' drag-and-drop features to change alarm levels.

SETUP: To install MONTOR, unzip the file MONTOR.ZIP into a directory on your hard disk, move the file DISKDLL.DLL into your Windows system directory (usually C:\WINDOWS\SYSTEM), and then create a Program Manager icon for MONTOR. If you want to run MONTOR automatically every time Windows starts, simply drag its icon into your Startup group. MONTOR requires the Visual Basic 3.0 runtime module VBRUN300.DLL. If you don't have this file on your system, download the file VBRUN3.ZIP from Library 10 of ZiffNet's TIPS forum and unzip it into your Windows system directory (usually C:\WINDOWS\SYSTEM).

REMARKS: MONTOR displays from five to eight gauges that register the percentage free of various system resources. The first three gauges correspond to the three Free System Resource values: System, GDI, and User. The fourth gauge tracks available memory, including virtual memory created by using a Windows swap file. The last one to four gauges monitor up to four fixed disks—hard disks, hard disk partitions, or RAM disks. If the system has fewer than four fixed disks, MONTOR's main window shrinks to omit the extra gauges.

Each gauge is a vertical line marked off in increments of 10 percent. To the left of the line is a yellow current-value pointer that graphically displays the value shown in the Free Percent label. The red warning-level pointer to the right of the line represents the Warn At label.

MONTOR initially sets the warning levels by reading values from the file MONTOR.INI. If this file does not yet exist, MONTOR sets the warning levels to a default value of 20 percent. To set a warning level yourself, just grab the pointer with the mouse and then drag it to the desired location.

PC Magazine's utilities are available by modem from PC MagNet, our on-line service. PC MagNet is part of ZiffNet, a group of on-line services from Ziff-Davis Publishing Company. ZiffNet is hosted by CompuServe Information Service.

THE FIRST TIME If you've never used ZiffNet, you'll need to find the access number nearest you. First, set your communications software to 7 data bits, even parity, no stop bits, and full duplex. Then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the closest access number. Or dial 800-635-6225 (voice) and follow the instructions.

HOW TO JOIN ZIFFNET Dial the local access number. At the HOST NAME prompt, enter CIS. At the USER ID prompt, type 177000.5000. When you see the PASSWORD prompt, enter PC*MAGNET. Finally, when you see the ENTER AGREEMENT NUMBER prompt, enter PCMAG93. Current CompuServe members can type GO PCMAG at any CompuServe ! prompt. Once you enter your billing information, you'll see your personal user ID and temporary password. A new password will arrive by mail within ten days.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

Peripherals

USING A DUAL-MONITOR SYSTEM

❓ I have a new 486DX/33 system with a local-bus SVGA video adapter in a VL-Bus slot and a color monitor. I also have an amber monochrome monitor with a Hercules graphics adapter. I'd like to run my text-based applications (such as WordPerfect) on the monochrome screen to save the wear and tear on my color monitor. I'm even willing to reboot to switch from one monitor to the other if necessary. Will this work?

*Robert Rustay
Schenectady, New York*

► **PC MAGAZINE:** Sure, it will work. High-end graphics workstations are routinely designed with two screens—one for graphics and one for text, so your idea is thoroughly modern.

All you have to do is put your monochrome card in an available slot, hook up the monitor, and power up your system. The system will then boot up to the VGA display, but you can switch back and forth between the two monitors without having to reboot. The DOS command `MODE MONO` will activate the monochrome display, and the command `MODE CO80` will switch back to the VGA screen.

Some programs, such as Windows, will automatically use the VGA display no matter what mode you're in when you begin (assuming, of course, that you have configured the program for a VGA or Super VGA display mode). Other programs, such as AutoCAD, can be configured to use both screens simultaneously, just like high-end graphics workstations.

The real question is whether you'll make your color monitor last any longer. By and large, monitors tend to function long after their specifications have been surpassed by newer and better models. The amber monochrome screen you still have is a good example. On the open market, it's probably worth \$30 or less (about a tenth of the original cost), but it still works well enough that you're considering using it now. This raises the question: What are you saving the color monitor for? It's likely that you'll want to replace it with a better one before it wears out. In addition, most of the wear and tear comes from turning the unit on and off, so you may just want to leave it on even when you are using the monochrome screen for text-based applications.

—*Alfred Poor*

KEEPING TRACK OF VENDORS

❓ Our company has a Complete FAX/9600. When we tried to contact the vendor at an address in Milpitas, California, the envelope came back marked "Not Deliverable as Addressed." Is The Complete PC Inc. still in business?

*James Cafky
CEM, Guam*

► **PC MAGAZINE:** The Complete PC Inc. is still in business and can be reached at 1983 Concourse Dr., San Jose, CA 95131, or by phone at 800-229-1753 or 408-434-0145.

Keeping track of vendors is actually quite a common problem for computer owners. Although software publishers will sometimes send notices about product upgrades, hardware manufacturers rarely communicate with owners. Since most of the products on the market are amazingly reliable, users usually don't need to contact the manufacturer for several years. When the time comes to change a configuration or move a peripheral to a new system, the addresses and phone numbers in the documentation are no longer current. Of course, some companies will go out of business, but most of the time they have just changed name or location or have merged with another company.

Fortunately, there's a ready resource that may help you locate a manufacturer that appears to be missing in action. On ZiffNet you can access the Computer Directory in the Computer Library (GO ZNT:COMPLIB). This directory lists more than 70,000 products, searchable by product category, product name, com-

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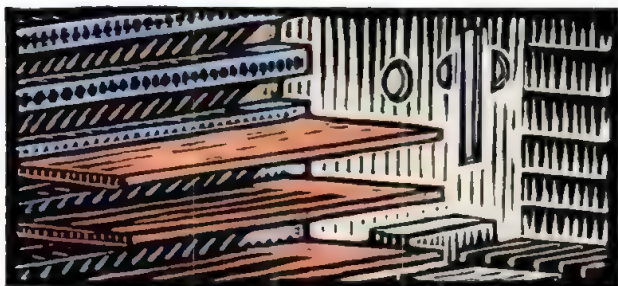
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pany name, and more. These entries include addresses and phone numbers for more than 12,000 manufacturers. If the maker of your old modem or printer is still in business, you should be able to track the company down.

—Alfred Poor



REORDERING THE DIRECTORIES ON YOUR DISK

❷ My \123DATA directory contains subdirectories named A, B, C, and D, which appear in that order when they are listed at the DOS prompt but in the sequence B, C, A, D when I retrieve a file in Lotus 1-2-3. Although I use all four of the subdirectories (and so have left \123DATA as my default path), I mostly need files from D, thus I frequently must tab past three directories in the 1-2-3 display. How can I make D the first in the list?

James T. Engh
Rochester, Minnesota

Douglas Boling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.
Frank J. Dertler, Jr., is senior networking editor and the author of the *PC Magazine Guide to Connectivity*.
Alfred Poor is a contributing editor and the author of *New Life for Old PCs*.
Jeff Prosser is a contributing editor and the author of the *PC Magazine Guide to DOS 5 Memory Management*.
Sal Ricciardi is a contributing editor and the author of the recent *Running FoxPro* books from Microsoft Press.
Neil Rubenking is technical editor and author of *Can Do DOS*,

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Ethan Winar is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities*.

► **PC MAGAZINE:** Your letter tells me two things: First, the *physical* order of the subdirectories within the \123DATA directory is B, C, A, D—the sequence 1-2-3 shows. Second, when you view the directory at the command prompt, you're either using a utility that sorts the result, or you've forced DOS (version 5.0 and up) to do the same by including the N parameter with the DIRCMD environment variable's /O switch (set DIRCMD=/O:N).

What you want is a utility that will physically arrange the directories on-disk in reverse alphabetical order, so they'll

appear that way even when no sorting occurs. Norton's Directory Sort (DS) utility can do the job, and many disk defragmenters (such as the one included with DOS 6.0) do it as a sideline. Simply sort the files in the \123DATA directory in reverse name order and D will come up first.—Neil J. Rubenking

CHANGING SCREEN COLORS WITH ANSI.SYS

❷ I wrote a batch file containing the command

```
PROMPT $e[3x;4ym
```

I thought this would cause the color of the batch file's on-screen text output to change as soon as the command executed, but the change occurred only after the entire batch file finished. I had ANSI.SYS running, so what did I do wrong?

Rolf Denger
North Salem, New York

► **PC MAGAZINE:** When ANSI.SYS is loaded, PROMPT becomes a handy vehicle for sending ANSI commands to the screen, because it lets you represent the tricky escape character using the string "\$e." You can, for instance, enter

```
PROMPT $e[33;44;1m
```

at the DOS command line and the next command you type will show up in yellow on blue. Give it a try! (Type your original PROMPT command afterward in order to restore your regular prompt.)

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Do you have a tip you think other readers could use? Or maybe you'd like a better understanding of how something works. If so, we invite you to let us know about it. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

It's easy to contact us. Just send us your submission (use ASCII format for text files) via the medium that's most convenient for you:

U.S. Mail: Solutions, *PC Magazine*, One Park Ave., New York, NY 10016-5802. (Please send a floppy disk along with a printout.)

Fax: 212-503-5799.

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PC MagNet: Select Submissions to PC Magazine from the main PC MagNet menu. Upload your file to the most appropriate library. If at any time you need help, simply type a question mark (?) and hit Enter; a list of commands will be displayed. If you are not already a member of PC MagNet but would like to join, follow the instructions on page 12 to find your local access number.

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For any tip we print, you'll receive \$50 plus a *PC Magazine* T-shirt. We regret that we cannot answer letters individually.

Operating Environments

Why isn't it working for you then? ANSI strings take effect only when they reach the screen. You must have set ECHO OFF in your batch file, which means DOS doesn't display the prompt and the ANSI codes can't reach the screen! They work only when the batch file ends and the prompt is displayed. To send ANSI commands via PROMPT from within a batch file, you must either put them before the initial @ECHO OFF line or temporarily set ECHO ON. For example:

```
@PROMPT $e[31;46;1m
```

```
@ECHO OFF
```

```
ECHO red on cyan
```

```
PROMPT $e[33;44;1m
```

```
ECHO ON
```

```
@ECHO OFF
```

```
ECHO yellow on blue
```

```
PROMPT $p$g
```

The first line sets the prompt to an ANSI string that selects red-on-cyan text. The

blank line that follows causes that prompt to be displayed, thus activating the command it contains. The second PROMPT selects yellow-on-blue text. This prompt isn't activated until the batch file sets ECHO ON and processes a blank line. You can dispense with the blank line in both cases by eliminating the @ sign from @ECHO OFF—if you don't mind ECHO OFF appearing on the screen.—Neil J. Rubenking

INCREASING THE DOS ENVIRONMENT IN WINDOWS

Windows seems to limit the environment space for DOS tasks. My CONFIG.SYS file contains the statement

```
SHELL=C:\DOS\COMMAND.COM C:\DOS  
/E:832 /P
```

The /E:832 should raise the environment space to 832 bytes—enough to start Quattro Pro from a batch file so that I can autoloading the one spreadsheet I use.

When I attempt this under Windows 3.1, though, I get an "Out of environment space" message. Can I get Windows to assign more environment space to a DOS task?

Daniel Sackett
Seattle, Washington

► **PC MAGAZINE:** One simple line added to SYSTEM.INI lets you specify any valid amount of environment space for COMMAND.COM under Windows. Note that this affects all batch files since Windows calls COMMAND.COM to execute them.

Load SYSTEM.INI into Notepad and find the [NonWindowsApp] section. Add the line

```
CommandEnvSize=nnn
```

(where *nnn* is whatever value you require—832 in your case), save the file, and exit Notepad. That's it. The change takes effect immediately, without restarting Windows!

By the way, the Windows Resource Kit

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says that in the absence of this line, the environment size defaults to the value set by the /E: switch on the SHELL= line in CONFIG.SYS. As you've noticed, this isn't the case; instead, you need to add the CommandEnvSize= line in SYSTEM.INI.—*Neil J. Rubenking*

DOSKEY DOUBLES DOS DIRECTIVES

✓**TIP** I stumbled upon a neat little trick and although I've found no use for it yet, I'm sure some of your readers will benefit from it. To place two DOS 5.0 commands on the same line, type the first, hit Ctrl-T—which appears on the screen as a new paragraph character (¶)—and then type the second command. Hit the Enter key and the two commands will execute sequentially.

*Gary S. Best
Somerville, Massachusetts*

►**PC MAGAZINE:** What you've found isn't a feature of DOS 5.0 but of its DOSKEY program, which apparently is loaded on your system. DOSKEY's three main functions are command recall, command line editing, and creating macros. DOSKEY macros are like tiny batch files, but they reside in memory so they execute much faster. Although a DOSKEY macro must be defined on a single line, it may include multiple commands. The Ctrl-T character is used to separate commands in a DOSKEY macro and as a side benefit can be used at the DOS prompt any time DOSKEY is loaded.

If you're looking for a use for your discovery, try this: Suppose you type a complicated command and then suddenly realize it won't work because you forgot to prepare by using some other command first. Instead of wiping out your complex command and starting over from scratch, press the Home and Ins keys (causing DOSKEY to move the cursor to the beginning of the command line), then type the preparatory command, ending with Ctrl-T. When you press the Enter key, the two commands will execute in sequence! You can put any number of commands on one line (up to the 127-character DOS limit), each separated by the Ctrl-T marker.—*Neil J. Rubenking*

Word Processing

PAGE X OF Y FOOTERS IN WORDPERFECT 5.x

✓**TIP** I frequently use footers that contain page numbers in the form "Page x of y." The footers are easy enough to create in WordPerfect—if you can remember all the keystrokes. The process is far from obvious, however, and takes enough work to qualify as a chore. The macro in Figure 1 fully automates the task. Although this is a quick-and-dirty, no-frills solution, it works just fine. Simply run the macro when you've completed editing a document. Note, however, that this macro can change the pagination of a multipage document (or add a page to a long single-page document, for that matter). So if you care where pages break, it's safest to look over the page breaks after running the macro but before printing.

*Stephen R. Bird
Phoenix, Arizona*

►**PC MAGAZINE:** The "Page x of y" numbering format is common enough to make this macro highly useful, no matter how quick and dirty it may be. Even better, some minor changes will make it just as quick and a little less dirty. Before looking at the macro itself, however, it's worth looking at the underlying technique, which Mr. Bird correctly characterizes as being far from obvious. (It's also worth noting that the same concepts will work in any program that allows cross-referencing—most notably, Word for DOS.)

Certainly the most straightforward way to refer to the total number of pages would be with a field that returns the number directly, just as ^B in WordPerfect returns the current page. Unfortunately, WordPerfect 5.x doesn't have any such field. The workaround that is used in Figure 1 goes to the end of the file, enters a place marker at the end, creates a footer that includes a page reference to the marker, and then updates the page reference. You can create the macro in Figure 1 by simply recording the key-

strokes that handle these steps in WordPerfect 5.0 or 5.1.

Start with {Home}{Home}{Down} to go to the end of the file. Then create the marker with Alt-F5 for {Mark Text}; choose Cross Ref, Mark Target; enter a name for the marker (Endfile in this case); and finish by hitting Enter. {Home}{Home}{Up} takes you back to the top of the file. To enter the footer, type Shift-F8 for {Format}, then choose Page, Footer, Footer A, Every Page.

To enter the footer itself, use Shift-F6 for the {Center} command and {B} to give the current page. To enter the cross-reference, type Alt-F5 for {Mark Text} then choose Cross Ref, Mark Reference, Page Number. WordPerfect will automatically suggest Endfile, the most recent marker you created, as the Target name. Hit Enter to accept it, then F7 twice for the {Exit}{Exit} that returns to the editing screen. The last line in Figure 1 updates the page reference. To create it, type Alt-F5 for {Mark Text}, then choose Generate, Generate Tables, Indexes, Cross References, and so on, and finally Yes.

As Mr. Bird points out, this macro can change pagination. But this is an easy problem to fix. The page breaks change because when you add a footer to a document, WordPerfect maintains whatever bottom margin you've set—or close to it, depending on the font size. You can easily sidestep the problem by changing the margin: Type Shift-F8 for Format, then choose Page, Margin, and adjust the bottom-margin setting.

In keeping with the quick-and-dirty spirit of the original macro, you could incorporate the bottom-margin adjustment into the macro itself. And indeed this fix works, as long as you always use the same font size and margins.

In my tests with 10- and 12-point text, the most commonly used font sizes, WordPerfect put the footer (or the last line of a multiline footer) where the last line of body text on the page would otherwise have gone and added a blank line above the footer. With a 1-line footer, you lose 2 lines of body text on each page. And because 10- and 12-point text print at roughly 6 lines per inch, or 1/6 inch per line, you could regain the 2 lines per page by adjusting the margin by about 1/3 inch

PAGNUM.WPM

Complete Listing

```
{DISPLAY OFF}{Home}{Home}{Down}
{Mark Text}rtEndfile{Enter}
{Home}{Home}{Up}
{Format}pfap{Center}Page{^B}of
{Mark Text}rrpendfile{Enter}{Exit}
{Exit}
{Mark Text}ggy
```



Figure 1: This WordPerfect macro, PAGNUM, for Version 5.0 or 5.1, provides a quick-and-dirty approach to adding a footer that includes page numbers in the format "Page x of y."

PNFOOT.WPM

Complete Listing

```
{DISPLAY OFF}{Home}{Home}{Up}
{Format}pfap{Center}Page{^B}of
{Mark Text}rrpendfile{Enter}{Exit}
m{Down}0.667{Enter}{Exit}
{Right}
```



Figure 2: The PNFOOT macro shown here, in combination with PNTARG in Figure 3, improves on the PAGNUM macro to avoid adding unnecessary control code. The version of the macro shown here also adjusts the bottom margin automatically to allow extra room for the footer.

PNTARG.WPM

Complete Listing

```
{DISPLAY OFF}{Home}{Home}{Down}
{Mark Text}rtEndfile{Enter}
{Mark Text}ggy
{Home}{Home}{Down}{Backspace}
{IF}{STATE}&512 ~ {QUIT}
{ELSE}y
{ENDIF}
```



Figure 3: After inserting the footer with the PNFOOT macro in Figure 2, the PNTARG macro shown here will insert the target reference, update the reference field in the footer, and then delete the target reference.

(2 lines times 1/8 inch per line). If you normally use a 1-inch bottom margin, for example, you would change the setting to 0.667 inches.

If you tend to use different size margins or greatly varying font sizes on different documents, you'll probably prefer leaving the margin adjustment out of the macro. If you choose to add the adjustment, however, you can add the keystrokes immediately after defining the footer but before updating the cross-referenced field. The only change would be in the next-to-last line in Figure 1, which would become

```
m{Down}0.667{Enter}{Exit}
```

Whether you add the margin adjustment to the macro or not, there's one

change you should make. As written, the macro assumes that once you run it, you won't make any further editing or formatting changes. If you do, and you then run the macro to update the reference in the footer, you'll wind up adding another footer code and Target reference code each time you run the macro. Although this normally won't have any effect on your output—assuming all your changes come before the target marker—it will unnecessarily clutter up your file with extra codes, as you will see if you type Alt-F3 for Reveal Codes.

There's another glitch that you may encounter if you've added text at the end of your document before running this macro again. If you already have a Target code and have accidentally entered any text after the code, the new code will show up after the text. And if the two codes are on different pages,

WordPerfect will list both pages in the footer.

A better option is to create two macros. The first one should insert the footer, and you can run it at any time—even before entering any text. The second should add the target reference code at the end of the file, update the cross-reference, and then delete the target reference code.

By entering the footer in a separate macro, you eliminate the clutter of having extra footer codes. And by deleting the target reference code each time, you eliminate both the clutter of extra codes and the possibility of two codes winding up on different pages.

Figures 2 and 3 show the two macros—PNFOOT and PNTARG. Note that PNFOOT differs slightly from the equivalent lines in Figure 1. PNFOOT spells

out Endfile as the name of the Target reference and includes the margin adjustment (which you may prefer to leave out). PNFOOT also ends by moving the cursor one character to the right, so any text you type will wind up after the footer code rather than before it.

The second macro, PNTARG, goes to the end of the file with {Home}{Home}{Down}, enters the Target code, updates the reference in the footer, and then goes to the end of the file and deletes the target code.

As always, when working in the WordPerfect macro editor, enter the commands shown in uppercase by typing Ctrl-PgUp, then pick the commands from the pop-up list. For commands in mixed upper- and lowercase, either type the appropriate keystroke, such as Alt-F5 for {Mark Text} or, for those keystrokes such as {Enter} that the macro editor will interpret as commands, type Ctrl-V followed by the appropriate keystroke.

All macros mentioned here can be downloaded from PC MagNet archived as PAGNUM.ZIP.—*M. David Stone*

Spreadsheets

NAMES IN QP'S EDIT MODE

TIP I make it a practice in Quattro Pro to name all cells that will be used in a formula or macro. The ability to give names to a cell or block of cells is one of the most important features of any spreadsheet. Names not only make entering formulas easier, they also make the formulas easier to understand.

But I have one major beef with Quattro Pro: Edit mode. I use the input line to review and check my formulas. If a formula is too long to fit on one line, I have to press F2 to enter Edit mode in order to see the entire formula. But when I do this, Quattro Pro replaces my block names with cell addresses. It's very disconcerting to see my painstakingly crafted name references turn into ugly, unreadable cell coordinates.

My solution is to use the search-and-replace command to change the formula to a label without using Edit mode. Your formula will retain the block names in the text of your label, and you can edit to

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your heart's content. I have written the following macro to automate the job:

```
\e      (/ Audit;SearchReset)
(/ Audit;ReplaceRange) ~
(/ Audit;SearchString){?} ~
(/ Audit;ReplaceString)'(?) ~
(/ Audit;Replace)y
```

To use this macro, position the cell selector over the cell you want to review, then type Alt-E. The macro will prompt you for the search and replace strings. Enter the first character of the formula in response to each prompt. The formula will become a label. When you've finished reviewing or editing, press F2 followed by the Home, Del, and Enter keys. This will remove the label prefix and turn the cell back into a formula.

*Stephen V. Gregory
Goode, Virginia*

► **PC MAGAZINE:** I agree that Quattro Pro's replacement of names with coordinates in Edit mode is odious. The behavior of Lotus 1-2-3 Release 2.x in this regard is equally obnoxious. However, your five-line macro seems like overkill. You can condense it to the single line

```
\e      {Edit}{Home} ~
```

This version also has the virtue of not requiring you to answer any prompts. To convert the label back into a formula, use this variant:

```
\d      {Edit}{Home}{Del} ~
```

I'd also like to call your attention to a little-noticed feature in Quattro Pro (both the DOS and Windows versions):

SEQPRT.WK1 Macro Listing

	A	B
1	REPLY	y
2		
3	\0	{getlabel "Do you want to print the budget plans? (Y/N)",REPLY){calc}
4		/fs ~ r
5		{if @upper(REPLY)<>"Y"/wey
6		/frBUDG_01 ~

Figure 4: This master macro worksheet asks you if you want to print a series of 1-2-3 spreadsheets and calls the first macro in the series if you type y or Y.

When you go into Edit mode, Quattro Pro replaces the filename display at the bottom of your screen with an unedited version of your formula. Block names in the formula remain visible here even though they disappear on the edit line.

It would certainly be nicer if Quattro Pro had the courtesy to leave your names in place on the Edit line (as 1-2-3 Release 3.0, 1-2-3 for Windows, and Excel all do). But having those names visible below the worksheet is a help nevertheless.—*Craig Stinson*

PRINTING A SERIES OF SPREADSHEETS IN 1-2-3

❏ **TIP** Employees routinely give me a number of separate 1-2-3 worksheets that have to be printed in sequence to form a report. In such cases, I've thought of storing an autoexecute (\0) macro on each worksheet, with each macro printing its own worksheet and then loading up the next worksheet. Unfortunately, this scheme leaves me without the possibility of simply retrieving a sheet to edit, unless I want to break into the autoexecute macro, which seems inelegant.

To give myself both flexibility and automation, I hit upon the solution shown in Figures 4 and 5. Figure 4 is a master worksheet that determines whether the whole sequence of worksheets should be printed. An autoexecute macro asks if the user wants the sequence to be printed. The user's response is stored in a cell named REPLY.

If REPLY is not y or Y, this initial macro quits by doing a /Worksheet Erase Yes. Otherwise, the macro calls the second worksheet, which contains the macro code shown in Figure 5. The second and all subsequent worksheets use a linking formula to fetch

SEQPR1.WK1 Macro Listing

	A	B
1	REPLY	+<<BUDG_PRT.WK1>>REPLY
2		
3	\0	{calc}
4		{if @upper(REPLY)="Y">{PRINTIT}
5		
6	PRINTIT	/ppagpq
7		/frBUDG_02 ~

Figure 5: Macro code like this is included in each of the subsequent worksheets to be printed.

the value of REPLY from the master worksheet, storing that value in a local cell that is also named REPLY. Autoexecute macros on each of these sheets then evaluate the local REPLY cell. If REPLY is affirmative, the macro prints and gets the next worksheet. If it is not affirmative, the macro stops.

Assuming there has been no interruption, the last worksheet reloads the master worksheet after all the printing is finished, giving the user the option of printing the whole sequence again.

*Martin Pruimers
Spijkenisse, Netherlands*

► **PC MAGAZINE:** Mr. Pruimers's "master switch" approach to chain printing is a good idea, particularly since it gives the user an easy way to repeat the chain if multiple copies are wanted (or if some printing mishap occurs midstream). It's also a less messy way to accomplish his goal than trying to put all the worksheets together with /File Combine commands.

But I must point out that it is possible to edit an autoexec macro without interrupting its execution! Just type /WGDAN—for /Worksheet Global Default Autoexec No. That will turn off the automatic execution of \0 macros for the duration of the current session. If you follow the N with a U (for Update), 1-2-3 will ignore your \0s from session to session—until you turn the feature back on.

If you're recreating Mr. Pruimers's macro chain, be sure to assign the labels REPLY, \0, and PRINTIT to the adjacent cells. Two notes about typing these macros: Be sure to type cell C3 on one line (it had to be broken to fit here). And note that cell B1 in Figure 5 is a formula, not a label. It's formatted as Text in the

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- PCMCIA slot
- MS-DOS 6.0, Windows 3.1, MS-Works for Windows

Hard drive	Price
170MB	\$1629*
200MB	\$2299

Lease for \$59.78/mo.

\$1629



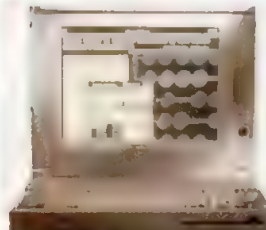

Bravo Notebook

- 486SX/25 Processor
- Accelerated local bus graphics
- PCMCIA Type III slot
- MS-DOS 6.0, Windows 3.1

Screen	Model	Hard drive	Price
Monochrome	84W	80MB	\$1699*
Monochrome	124W	120MB	\$1799
Monochrome	124W	170MB	\$1899
Dual scan color	124W	120MB	\$2449
Dual scan color	173W	170MB	\$2559
Active matrix	173W	170MB	\$3349

Lease for \$62.35/mo.

\$1699



COMPAQ

LTE Lite 4/25

- 486SL/25 processor
- 4MB RAM, expandable to 20MB
- Trackball, MS-DOS, Windows 3.1
- 3-year warranty

Screen	Hard drive	Price
Monochrome	120MB	\$2089*
Monochrome	209MB	\$2369
Active Mono	120MB	\$2819
Active Mono	209MB	\$3099

Lease for \$76.66/mo.

\$2089



COMPAQ

Contura

- 486SL/25 processor
- 4MB RAM
- Trackball, MS-DOS, Windows 3.1
- 3-year warranty

Display	Hard drive	Price
Monochrome	209MB	\$2199*
Dual scan color	120MB	\$2699
Dual scan color	209MB	\$2879

Lease for \$80.70/mo.

\$2199



Canon

NoteJet

- 25 MHz 486SLC
- 4MB RAM, expandable to 12MB
- 9.5" backlit mono display
- 2 PCMCIA Type II slots
- Bubblejet printer built-in
- 116 cps, 360x360dpi
- Auto sheet feeder built in

Hard drive	Price
135MB hard drive	\$2539*
180MB hard drive	\$2699

Lease for \$93.18/mo.

\$2539



NEC

UltraLite Versa

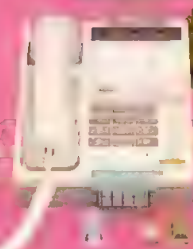
- 4MB RAM, expandable to 20MB
- 2 PCMCIA slots
- Local bus graphics
- Upgradable processor, screen, hard drive
- MS-DOS 6.0, Windows 3.1, trackball

Processor	Screen	Hard drive	Price
486SL/25	Active color	120MB	\$3799
486SL/25	Active color	180MB	\$4049
486SL/33	Monochrome	180MB	\$3229
486SL/33	Monochrome	250MB	\$3439
486SL/33	Active color	180MB	\$4299
486SL/33	Active color	250MB	\$4499

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What does this mean to you? Simply this: If you're a notebook PC buyer, you owe it to yourself to seriously consider a TI TravelMate. TI makes the industry's widest range of 486 notebooks optimized for Windows with processors ranging from 25MHz to 50MHz and including monochrome and color models. Whatever your needs, there's a TravelMate that's right for you.



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TI's TravelMate 4000E WinDX2/50 is the "no compromise" 486 notebook that performs like a desktop PC.

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- ▲ NEW 4mm full-travel keyboard with true desktop feel
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- ▲ NEW high-speed video system for fast Windows performance
- ▲ NEW 4mm full-travel keyboard with true desktop feel
- ▲ 4MB RAM expandable to 20MB
- ▲ 120MB hard drive
- ▲ Pre-installed DOS 6 and optimized Windows 3.1



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- ▲ Pre-installed DOS 6 and optimized Windows 3.1



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PC Magazine Award Winner

"The TI TravelMate 4000 WinDX2/50 continues to be the top gun of the portable world, outperforming several DX2/66-based systems."

— PC Magazine, August 1993



TravelMate 4000 WinDX 2/50



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- ▲ 82 key keyboard
- ▲ BallPoint mouse with QuickPort
- ▲ MS-DOS 6.0, Windows 3.1

Model	Screen	Hard drive	Price
T1900-486SX20	Monochrome	120MB	\$1,799*
T1900-486SX20	Monochrome	200MB	\$2,099
T1900-486SX20	Dual Scan Color	120MB	\$2,399
T1900-486SX20	Dual Scan Color	200MB	\$2,699
T1950-486DX2/40	Monochrome	120MB	\$2,159
T1950-486DX2/40	Monochrome	200MB	\$2,399
T1950-486DX2/40	Dual Scan Color	120MB	\$2,769
T1950-486DX2/40	Dual Scan Color	200MB	\$3,029

*Lease for 65.28/mo.



T4600

Exceptional performance

- ▲ 33MHz 486SL processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ 2 PCMCIA slots: 16mm Type IV & 5mm Type II
- ▲ 82 key keyboard
- ▲ BallPoint mouse with QuickPort
- ▲ MS-DOS 6.0, Windows 3.1

Screen	Hard drive	Price
Monochrome	120MB	\$2,629
Monochrome	200MB	\$2,899
Active Matrix Color	120MB	\$4,099
Active Matrix Color	200MB	\$4,359
Active Matrix Color	340MB	\$4,799

Lease for 96.48/mo.



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- ▲ 486DX2/66 processor
- ▲ 8MB RAM, expandable to 40MB
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- ▲ 2 built-in stereo speakers
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- ▲ MS-DOS 6.0, Windows 3.1, Asymetrix COMPEL and MediaBlitz!

Model	Description	Price
T6600C	Base model	\$6,799*
T6600C/CD	Base model + Toshiba 25	
	200MS CD-ROM drive	\$1,429
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	Mambo DVI board	\$8,389

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486SX/33	170MB	\$1099
486DX/33	170MB	\$1239
486DX/33	260MB	\$1349
486DX/2/50	260MB	\$1499
486DX/2/66	260MB	\$1599

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\$979



COMPAQ

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- 4MB RAM expandable to 32MB
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- Local Bus graphics
- MS-DOS 6.0, Windows 3.1, Mouse

Model	Hard drive	Price
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486SX25	240MB	\$1089
486DX33	120MB	\$1389
486DX33	240MB	\$1469
486DX2/66 Bundle	340MB	\$2299

Compaq SVGA color monitor \$349.99
Lease for \$50/mo.

\$999



Bravo Desktops

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- Local bus video 1024x768
- OverDrive and P24T upgradable

Model	123/W	213/W	Price
4/25s	120MB		\$1029*
4/33	120MB		\$1299
4/33		210MB	\$1539
4/66d		210MB	\$2099

Color SVGA monitors start at \$399.99

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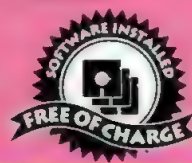
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Model	RAM	Hard drive	Price
4/25s	4MB	170MB	\$1179*
4/33	4MB	170MB	\$1449
4/33	8MB	340MB	\$1899
4/66d	8MB	340MB	\$2449

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- Labtec speakers
- Headphone/Microphone
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- CD-ROM titles include: PFS: Window Works, Compton's Encyclopedia, Dinosaur Adventure & Space Adventure

Processor	Hard drive	Price
486SX25	170MB	\$1499*
486SX33	250MB	\$1899

Lease for \$55.01/mo.

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figure so you can see how to type it in. The formula itself will return 0 until you've run the suite at least once.

You can download these macros from PC MagNet archived as SEQPRT.ZIP.

—Craig Stinson

Graphics

IMPORTING PRINT SHOP GRAPHICS INTO WP

❓ I work with Print Shop, WordPerfect 5.1, and DrawPerfect 1.1. How can I import the graphics from PrintShop into WordPerfect and DrawPerfect, and vice versa?

Floyd Farrell
Alberta, Canada

► **PC MAGAZINE:** It depends entirely upon which version of Print Shop you're using. Broderbund (425-382-4400) offers two different versions of Print Shop: The New Print Shop and Print Shop Deluxe. If you use The New Print Shop (or an earlier version of the program), you are going to have a tough time sharing files, because The New Print Shop creates and stores images using a proprietary format. The program neither exports nor imports any standard file formats.

In contrast, Print Shop Deluxe offers a utility that can convert images you create within the program into standard file formats such as .PCX, TIFF, and EPS. You'll find this separate utility program, appropriately called EXPORT.EXE, in your Print Shop Deluxe subdirectory.

In a perfect world, you'd be able to transfer files freely between WordPerfect, DrawPerfect, and Print Shop Deluxe. In reality, these three programs offer a frustrating mix of import and export functions. So although Print Shop Deluxe can export .PCX, TIFF, and EPS files, it can't import them. And while WordPerfect 5.1 can import these formats, it can't export them. Only DrawPerfect—as you'd expect of a fully functional drawing program—can both read and write these graphics formats. So, if you currently own Print Shop Deluxe, you'll find yourself on a one-way street. You can get images out of Print Shop De-

luxe and into WordPerfect or DrawPerfect, but your files can't travel in the opposite direction.

However, the latest release of Print Shop Deluxe—Version 1.2—does have the ability to both export *and* import .PCX, TIFF, and EPS images. If you are upgrading from Print Shop Deluxe 1.0, your cost is minimal—only \$15. If you are upgrading from The New Print Shop, you'll have to pay the full price of \$49.95.

There is one technique that allows you to produce graphics files from *any* program, including The New Print Shop or WordPerfect—using a screen capture program that saves the currently displayed image to disk. There are a number of programs that offer screen capture and file conversion functions. (For comparative reviews see "The Image Crusaders: 12 Screen Capture and Conversion Utilities," April 13, 1993.)

—Luisa Simone

EASY DECORATIVE BORDERS

❗ **TIP** I frequently use decorative borders in my design projects, but canned clip-art borders often require lots of editing in an illustration program before I can use them in my DTP documents. I also got tired of buying clip-art collections.

I found a quick, inexpensive way to add borders and patterns to my documents: I use QuarkXpress for Windows to string dingbat characters together. It lets you control the color, shade, leading, and kerning of the text, so it's easy to align individual characters. You can build complex patterns by overlapping and then grouping multiple text frames.

It's a good idea to turn text runaround, or wrap, off for the objects that are part of the border or pattern. Make the backgrounds of the text frames transparent by assigning a fill of None. These settings are very important if you are overlapping multiple objects as part of the design.

Penna Bonita
New York, New York

► **PC MAGAZINE:** As you can see by the two sample patterns I created (Figure 6),

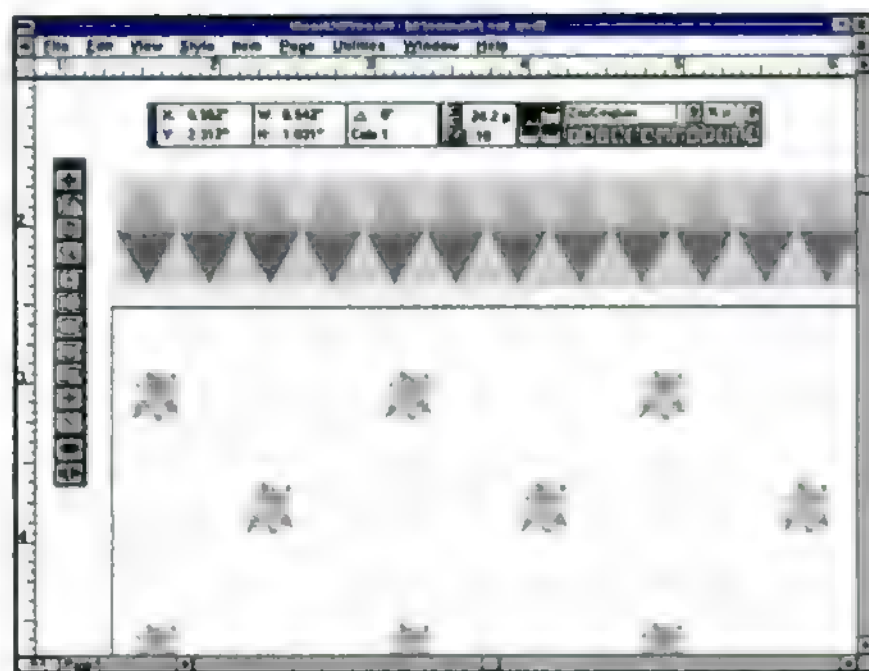


Figure 6: By adjusting both leading and kerning, you can create interesting patterns using dingbat characters. Here, two different Type 1 fonts—Zapf Dingbats (top) and Woodtype Ornaments 2 (bottom)—were used to create a border and a background pattern, respectively.

this technique offers a wide range of design options. The top object is a border built from Adobe Zapf Dingbat characters. If you look closely at the floating control palette, you'll see that the characters have been arranged into a solid pattern by applying negative kerning and leading values. The bottom object takes advantage of another dingbat font from Adobe—Woodtype Ornaments 2. But in this case I used forced justification and tab stops to create a wide open background pattern. In both cases I employed light-gray tints, a good choice if you are printing to a desktop laser printer or intend to use the pattern behind text.

There are several other benefits associated with this technique. Because it takes advantage of the plethora of inexpensive Type 1 and TrueType fonts on the market, you can easily add lots of new patterns to your design arsenal by purchasing a font library instead of a clip-art library. Your dingbat borders are not only money savers, but time savers as well. Because the dingbat characters are sent to the printer as text rather than pictures, they print faster than clip-art borders or conventional drawings. Best of all, this technique isn't limited to QuarkXpress. In fact, it will work with just about any desktop publishing or illustration program on the market—including Aldus PageMaker, Ventura Publisher, Microsoft Publisher, CorelDRAW, and Adobe Illustrator.

—Luisa Simone

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—PC Magazine, August 1993

"The TI TravelMate 4000 WinDX2/50 continues to be the top gun of the portable world, outperforming several DX2/66-based systems."
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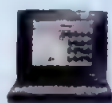
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- ▼ **Available in upgradable Active Matrix, Dual Scan Passive Matrix or Monochrome Displays**
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5325 25MHz Active Matrix	\$3250
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Picture your ideal computer system. Does it have a large hard drive... a high-resolution monitor...a sleek, sturdy design? The system you're imagining can be a reality. Call the computer professionals at MidWest Micro today.

Winner of 14 Computer Shopper Best Buy Awards and PC Computing's Five-Star Rating for outstanding service and price performance, MidWest Micro offers creative, cost-effective solutions for all your computing needs.

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Our System Consultants do more than answer questions; they listen to your needs, analyze the situation and then recommend a solution. You can depend on MidWest Micro's Technical Staff to help keep your Elite up and running through even the most difficult applications.



Guaranteed Performance

Because you need a computer you can depend on, Elite Systems, Notebooks and SubNotes are backed by a one year warranty. During that time we offer immediate parts replacement for components which you can easily install. For internal repairs, simply send us your system or notebook and we'll correct the problem within 72 hours.

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Why wait weeks to get the system you want? Order from MidWest Micro and get your Elite System or Notebook fast. Most standard configurations are shipped within 24 hours. If you'd prefer a custom configuration, we'll do our best to have it on your doorstep within 72 hours.

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Get your system or notebook the way you want it. We can install fax modems, Microsoft Windows, more RAM, a larger hard drive and all the other accessories you've been looking for in a system. Ask your sales representative for details.



Elite Systems — The Reason Other Companies Are Going Back To The Drawing Board

Classic Styling

Each component of an Elite System perfectly complements the other. From the fastest motherboards to the highest resolution monitors, the most reliable hard drives and the durable cases which frame our Elite Systems, you can be sure you're getting the best system available for your money.

Rich In Features

Elite Systems come with SVGA cards, high-speed RAM, 3.5" floppy drives, formatted hard drives and Microsoft DOS 6.0 and Microsoft Windows* installed.

Call MidWest Micro today. You'll be glad you did.

*Some configurations do not ship with Windows.



VESA Value Systems 486DX-33 \$1499

#006329

Elements

- VESA Local Bus Motherboard
- Intel 80486DX-33 Processor
- 128K High-Speed Cache
- 4 Mb High-Speed RAM
- 32-Bit VESA Local Bus IDE Card
- 245 Mb IDE Hard Drive
- 1.44 Mb 3.5" Floppy Drive
- 1.2 Mb 5.25" Floppy Drive
- 14" SVGA .28 Non-Interlaced Color Monitor
- 32-Bit VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- 5-Bay Mini-Tower Case
- FREE Microsoft DOS 6.0 Installed
- FREE Microsoft Windows Installed

486DX2 -50 \$1569

#006330

486DX2 -66 \$1699

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VESA Windows Systems 486DX-33 \$1649

#006332

Elements:

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- Intel 80486DX-33 Processor
- 128K High-Speed Cache
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- 32-Bit VESA Local Bus IDE Card
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- 1.44 Mb 3.5" Floppy Drive
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- 4 Mb High-Speed RAM
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- ✓ 3 Disk CD-ROM Software Library
- ✓ 16-Bit High-Performance Sound Card
- ✓ Digital-Quality, Compact Speakers
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- 32-Bit VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- 5-Bay Mini-Tower Case
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- FREE Microsoft Windows Installed

486DX2-50 \$1949

#006336

486DX2-66 \$2099

#006337

VESA CAD Systems 486DX-33 \$2329

#006338

Elements:

- VESA Local Bus Motherboard
- Intel 80486DX-33 Processor
- 256K High-Speed Cache
- ✓ 8 Mb High-Speed RAM
- 32-Bit VESA Local Bus IDE Card
- ✓ 340 Mb IDE Hard Drive
- 1.44 Mb 3.5" Floppy Drive
- 1.2 Mb 5.25" Floppy Drive
- ✓ 17" SVGA .28 Non-Interlaced Digital Color Monitor
- ✓ Diamond Stealth 24 VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- 7-Bay Full-Tower Case
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For robust power
management and long
battery life, choose

Elite 486SX/DX Notebooks featuring Intel's 486 "SL-Enhanced" microprocessors. Designed especially for portable computers, these chips support the system management mode (SMM) which lets power management software operate independently of the operating system. And because they have a static design, the clock signal can be slowed or stopped to conserve power.

Beyond power management, Intel's 486 "SL-Enhanced" processors are upgradeable to deliver the high-end processing speeds you'll need in the future. Choose between a 486SX-25, 486DX-33 or 486DX2-50 and feel confident that the Elite Notebook will meet your needs for years to come.

486SX/DX Notebooks are available with a 10" active-matrix

color, dual-scan color or monochrome screen and up to a 340 Mb hard drive to capture your work in style. For maximum versatility they also come with a PCMCIA Type III slot which accepts two Type II cards or one Type III card. Swap modems, LAN, storage, or flash cards without powering down.

Order your 486SX/DX Notebook today and discover how Elite Notebooks raise computing to a fine art.



120 Mb	486SX-25	486DX-33	486DX2-50
Monochrome	005501 \$1599	005516 \$1849	005531 \$1999
Dual-Scan Color	005506 \$2349	005521 \$2599	005536 \$2749
Active-Matrix Color	005511 \$3199	005526 \$3399	005541 \$3599

For an 80 Mb hard drive subtract \$40. For a 200 Mb hard drive add \$100.

For a 340 Mb hard drive add \$280.

Elements:

Processor:

Intel 486SX-25, 486DX-33 or
486DX-50 SL-Enhanced
upgradeable processor

RAM:

4 Mb, expands to 20 Mb

Hard Drive:

80 Mb, 120 Mb, 200 Mb or 340 Mb

Screen:

10", 640 x 480 VGA resolution
Backlit display
Color - 256 colors
Monochrome - 64 gray shades

Battery Life*:

Active-Matrix Color - 3 hours
Dual-Scan Color - 4 hours
Monochrome - 6 hours

Weight:

Color - 6.9 lbs.

Monochrome - 6.4 lbs.

512K DRAM plus 64K

VRAM for turbo bus
accelerated video technology

Simultaneous video on active-matrix
and monochrome models

86 keys with 101-key emulation

Built-in trackball

Built-in 1.44 Mb, 3.5" floppy drive

Advanced Power Management

One parallel and one serial port

External VGA and keyboard connectors

One PCMCIA Type III slot/ two
Type II slots

FREE AC adapter and utilities disk

FREE MS-DOS 6.0 installed

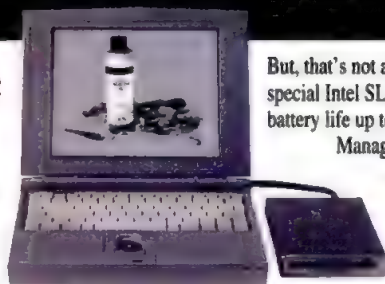
*Battery life measured with Power Management enabled. Actual battery life may vary.

Brilliant Ideas Require Brilliant Performance

Elite 486SX-25 SubNote

Illustrate Your Points On This 10" Screen

You'd think a small 3.9 lb. SubNote would be hard to work on—but it's not. Elite's 486SX-25 SubNote delivers 640 x 480 VGA resolution on its 10" high-contrast screen so you can illustrate charts and graphs that are easy to read. And unlike other notebooks that leave your wrists hanging, the Elite SubNote offers a built-in trackball and extended palm rest to support wrists.



But, that's not all! The Elite SubNote receives rave reviews for its special Intel SL-Enhanced processor that conserves power and extends battery life up to five hours when combined with Advanced Power Management.

For extra power take advantage of the SubNote's PCMCIA Type II slot. It lets you insert credit-card sized PC cards for modems, flash memory, network adapters and more.

Get the picture? Now get the Elite 486SX-25 SubNote and get a whole new view of portable computing!

486SX-25 SubNote

Model	Item #	Price
80 Mb	005575	\$1499
120 Mb	005576	\$1549
200 Mb	005577	\$1639
340 Mb	005578	\$1799

Elements:

Processor:
Intel 486SX SL-Enhanced upgradeable processor

Processing Speed:
25 MHz

RAM:
4 Mb expands to 12 Mb

Hard Drive:
80 Mb, 120 Mb, 200 Mb or 340 Mb

Screen:
10", 640 x 480 VGA resolution

Backlit display
64 gray shades

Battery Life*:
5 hours

Weight:
3.9 lbs.

512K DRAM plus 64K VRAM
for turbo bus accelerated video technology

Simultaneous video
83 keys with 101-key emulation

Built-in trackball

External 1.44 Mb, 3.5" floppy drive

Advanced Power Management

Nickel metal hydride battery

One parallel and one serial port

External VGA and keyboard connectors

One PCMCIA Type II slot

FREE AC adapter and utilities disk

FREE MS-DOS 6.0 installed

Elite 486SLC-33 Color/Monochrome Notebook

486 Notebooks At Starving Artist Prices

Get more power for your money with Elite 486SLC-33 Notebooks. Available in color or monochrome, these notebooks come with fast 33 MHz Cyrix processors, internal cache memory, and up to 8 Mb of RAM.

For maximum system flexibility, you can add an additional RAM module, a V.42bis internal fax modem or an external docking station.

Both models provide non-glare VGA screens that eliminate distortion, flickering and eye strain so you can compute



comfortably. Text and graphics appear at 640 x 480 resolutions in 64 gray shades or an eye-catching 256 colors for graphic and spreadsheet applications.

And if you get caught up in your creative endeavors, a quick glance at the LCD panel lets you know which drives are being accessed, when battery power is low, what function keys are enabled, whether external power is being used and if there is a modem ring.

Affordably priced Elite 486SLC-33 Color/Monochrome Notebooks are a real work of art. Order yours today!

486SLC-33 Notebooks

Color		
Model	Item #	Price
80 Mb	005461	\$1699
120 Mb	005466	\$1769
200 Mb	005471	\$1889

Monochrome		
Model	Item #	Price
80 Mb	005446	\$1209
120 Mb	005451	\$1279
200 Mb	005456	\$1399

Elements:

Processor:
Cyrix 486SLC-33

Processing Speed:
33 MHz

RAM:
2 Mb RAM, expands to 8 Mb

Hard Drive:
80 Mb, 120 Mb or 200 Mb

Floppy Drive:
Built-in 1.44 Mb 3.5"

Screen:
Color - 9", 256 colors
Monochrome - 10", 64 gray shades

Video RAM:
Color - 512K
Monochrome - 256K

Keyboard:
83 key with 101-key emulation
2-button thumbball mouse

Weight:
Color - 5.7 lbs. with battery
Monochrome - 5.4 lbs. with battery

Battery Life*:
Color - 4 hours
Monochrome - 6 hours

640 x 480 resolution

Simultaneous video

Advanced Power Management

One parallel and one serial interface

External VGA monitor and keyboard connectors

FREE AC adapter carrying case and MS-DOS 6.0 installed

One year manufacturer's warranty



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*Battery life measured with Power Management enabled. Actual battery life may vary.

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DOT MATRIX PRINTERS

M-1809	000009	\$309
M-1909	000011	\$349

INK JET PRINTER

HJ-400	004087	\$279
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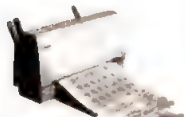
LASER PRINTERS

HL-10h	004363	\$1249
HL-10PS	004089	\$1499
HL-10V	004060	\$959

Canon

BUBBLE JET PRINTERS

BJ-10ex	002056	\$249
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BJ-200
\$259*
002815

BJ-230	002818	\$379*
BJC-600	002819	\$599
BJC-800	002816	\$1495
BJC-820	002817	\$1599

LASER PRINTERS

LBP-4SX	002979	\$699
LBP-430	003038	\$599
LBP-8SX	003037	\$1029

CITIZEN

DOT MATRIX PRINTERS

GSX-145	001179	\$369
GSX-190	002994	\$167
200GX Fifteen	002942	\$309
GSX-230	002995	\$229
GSX-240	003085	\$279

PORTABLE PRINTER

PN48 Pro	002943	\$209
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LASER PRINTER

ProLaser 6000	003098	\$699
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EPSON

DOT MATRIX PRINTERS

AP-2250	003550	\$125
AP-3250	003090	\$179
DFX-5000	001180	\$1399
DFX-8000	001182	\$2349
FX-870	002094	\$279
FX-1170	004099	\$369



LQ-570+
\$249
002099

LQ-870	001987	\$465
LQ-1070+	002105	\$389
LQ-1170	001988	\$635
LQ-2550	000074	\$939
LX-810	000645	\$175

INK JET PRINTERS

Stylus 300	003554	\$239
Stylus 800	003552	\$329

LASER PRINTERS

AL1000	002125	\$639
AL1500	002185	\$679
EPL-8000	001194	\$875

LEXMARK

DOT MATRIX PRINTERS

IBM Personal Printer 2380	005907	\$325
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IBM Personal Printer 2381

005908	\$449
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IBM Personal Printer 2390

005909	\$325
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LASER PRINTERS

IBM LaserPrinter 10	005902	\$1139
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IBM Duplex LaserPrinter 10R

005940	\$1929
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IBM LaserPrinter 12R

005938	\$1759
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NEC

DOT MATRIX PRINTERS

Piwriter P3200	002842	\$229
Piwriter P3300	002843	\$329
Piwriter P6200	002840	\$409
Piwriter P6300	002841	\$619

THERMAL JET PRINTER

Jetmate 1000	002849	\$285
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LASER PRINTERS

Silentwriter 95f	002845	\$889
Silentwriter 95fx	002847	\$1109
Silentwriter 97	003140	\$1079
Silentwriter 97fx	003175	\$1299

Panasonic

DOT MATRIX PRINTERS

KX-P1150	001672	\$135
KX-P1624	001052	\$349
KX-P1654	001594	\$549
KX-P1695	000018	\$369
KX-P2023	001658	\$199
KX-P2123	001654	\$235
KX-P2124	001657	\$309
KX-P2180	001653	\$159
KX-P2624	001651	\$369

LASER PRINTERS

KX-P4410	001656	\$559
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KX-P4430

\$669
001655



KX-P4440	001674	\$1249
KX-P4451	001615	\$1399
KX-P4455	001596	\$1729
KX-P5410	001676	\$1029

SAMSUNG

DOT MATRIX PRINTER

SP-2412	004572	\$165
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LASER PRINTERS

Finale 8000	004550	\$1119
Finale 8000i	004571	\$1769

SEIKOSHA

DOT MATRIX PRINTERS

BP-5780	001897	\$1175
LT-20XL	001893	\$305
SP-2000S	001900	\$195
SP-2400AI	003040	\$149
SP-2400AP	003041	\$219

star

DOT MATRIX PRINTERS

NX-1001	001597	\$139
NX-1040 Rainbow	004080	\$165
NX-2420 Rainbow	001600	\$289
NX-2430 Multi-Font	002935	\$235

THERMAL FUSION PRINTER

SJ-144	004067	\$479
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LASER PRINTER

LS-5 Laser w/toner	004362	\$699
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MODEMS

Infotel

PCMCIA FAX MODEMS

9624 PCMCIA	001722	\$199
9648 PCMCIA	001624	\$179
14.4 PCMCIA	001812	\$299

MODEMS

2400 Ext.	004750	\$55
2400 Int.	004700	\$35
2400 Pocket	001702	\$49

FAX MODEMS

9624 Ext.	001556	\$79
9624 Int.	004702	\$49
9624 Pocket	001688	\$75
9624 V.42 Ext.	004755	\$99
9624 V.42 Int.	004705	\$89
9624 V.42 Pocket	001697	\$99



14.4 Int.
\$139
004766

14.4 Ext.	004765	\$159
14.4 Pocket	001673	\$169

Robotics

MODEMS & FAX MODEMS

Sportster 9600 V.42bis Ext.	003693	\$159
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Sportster 9600 V.42bis Int.

003692	\$155
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Sportster 9600 V.42bis Fax Ext.

003691	\$175
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Sportster 9600 V.42bis Fax Int.

003690	\$165
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Sportster 14,400 V.42bis Ext.

003689	\$179
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Sportster 14,400 V.42bis Int.

003688	\$159
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Sportster 14,400 V.42bis Fax Ext.

003687	\$209
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Sportster 14,400 V.42bis Fax Int.

003686	\$179
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HARD DRIVES

SAMSUNG

125 Mb	004573	\$169
250 Mb	004559	\$245

Seagate

44 Mb	003450	\$129
89 Mb	003451	\$175
130 Mb	003452	\$183
210 Mb	003453	\$229
260 Mb	004059	\$259
340 Mb	004057	\$339

MONITORS

ELITE

ELITE MONITORS

14" .39mm SVGA Color	005702	\$209
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14" .28mm SVGA Color

005711	\$239
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14" .28mm
N/I SVGA
Color
\$259
005716

15" .28mm N/I SVGA Color

005721	\$349
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15" .28mm N/I Digital Color

005730	\$359
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17" .26mm N/I Multi-Sync Color

005724	\$699
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CTX

5468NT	004055	\$279
5439A	004270	\$219
5468A	004085	\$255
CMS-1561	004275	\$379
CPS-1760DF	004295	\$749
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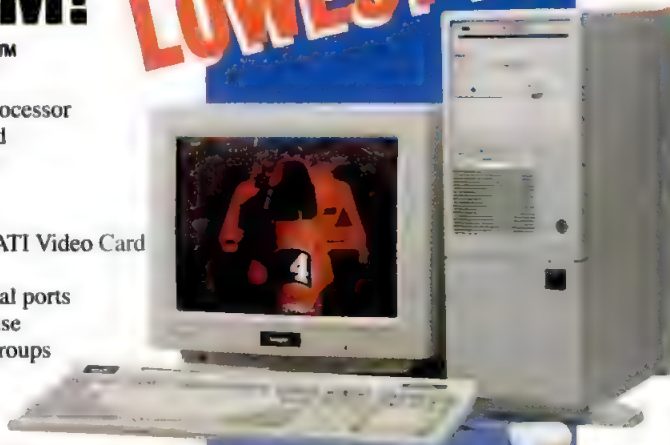
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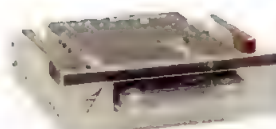
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92.7

62.3

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552.3

413.3

pages/sec

16-bit Real Mode Mix

597.0

450.0

pages/sec

Floating Point Emulation

1,102.2

830.4

ops/sec

Main Coprocessor

19.6

14.8

K-ops/sec

Memory Performance

Ext. Memory 16-bit Read/Write

12,767.0

9,638.0

K/sec

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22,190.0

16,668.0

K/sec

Conv. Memory 16-bit Read/Write

15,122.5

9,550.0

K/sec

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Direct Screen Write (16-bit)

7,517.6

6,559.0

K-char/sec

Screen to Screen Bitbit (16-bit)

12,380.2

10,460.2

K-

pixels/sec

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12,664.3

K-

pixels/sec

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909.6

663.2

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16.7

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606.1

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3,022.4

2,371.1

K/sec

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1,669.1

1,147.9

K/sec

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CPU Manufacturer

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Intel

CPU Type

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486DX2/50

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8

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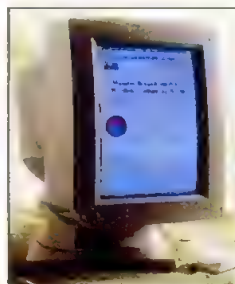


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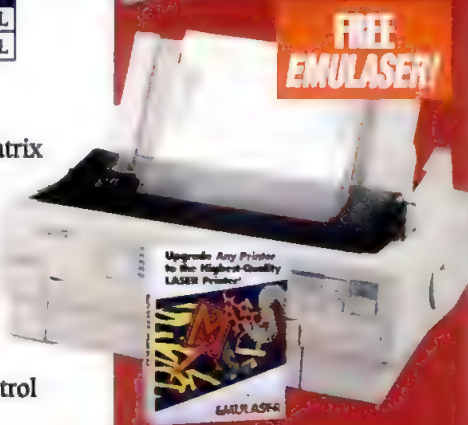
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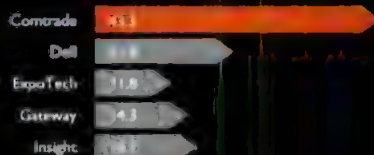
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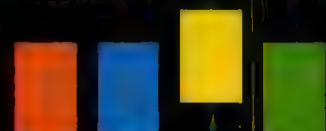
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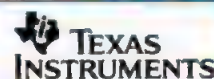
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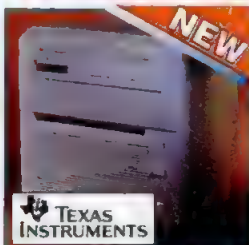
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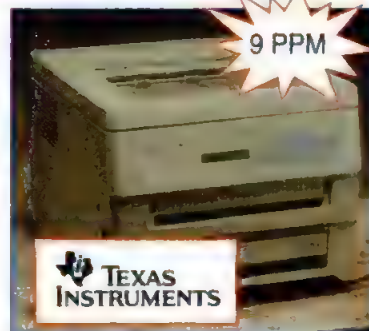
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Error Correction (V.42, MNP 1-4)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
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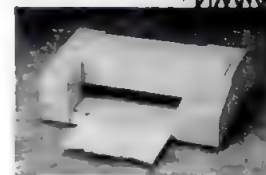
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SMC Ethercard +/-16	\$89/\$115
3 Com EtherLink II	\$179
3 Com Etherlink III	\$119
Etherlink III 5 Pack	\$529
Intel Ether 16	\$89
Intel Ether 16-5 Pack	\$429
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Intel Ether EISA 32	\$509
Intel Token 16/S	\$389
Irma Board 3	\$399
Xircom Pocket Ethernet ..	\$269

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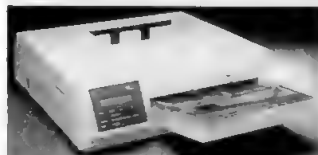
Epson 600C/800C ..	\$779/\$1069
Epson Action Scanning ..	\$989
Logitech ScanMan 256 ..	\$169
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Summasketch 12x12	\$255
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1124I	\$229
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2624	\$359
3123	\$279
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4455	\$1659
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ML395C	\$1029
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 6 FG/6 FGP \$2249/2299

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Advantage	386SX/20, 25, 33MHz	SV/25, Bravo 3/33	P/25/25/286, 30/286, memory optional 1497259	
2MB	500942/001	597	500947/002	\$215
Advantage	Pro 68040/32, 50/25, Bravo 1/4/25x, 33, 33x, 50x/4/44x		P/25/355X, 15, 4055X, 50X, 555X, 15, 655X, 15, 70, 55040	591
Advantage	500987/001	530	1MB	445064/03
16MB	500987/004	5447	500988/005	\$895
Power	104, 25, 33, 372, 727	Power	386SX/14, 20, 25	

1MB w/WP	506780-002; 002	\$30	2MB	645060	\$100
Advantage! 484/25; 33; 33x; S30; Bravo 4/33; 484/25; Premium 4/25; 33Tt; Server SE 4/23			P5/2 355K; LS; 405K; 555K; LS; 455K; LS; Xtension; P5/Valueport Cxx series; adapter board 34F3011 or 34F3077		
2MB w/WP	506718-004; 790-005	\$96	4MB	34F2933 or 37EP977	\$195

4MB w/WP5	5007780-0004	5177	P5/2 90 XP, P5 XP, P75 (sams), 56, 57 (intl), P5/1 Pro M2123	5810
Advantage! 486/25; 33; 33x; SX20, Power Premium 3/33,			2MB 4450902	587
4/33; 33x; 504 640, Premium 386/33T1, 486/75, 25x; 25T1,			P5/2 90 XP, P5 XP, P75 (sams), 56, 57 (intl), P5/1 Conquest, Essential,	
33; 33x; 33T1, Premium II 386/75, 33; 486/33, 486S2/20			Expert models s1, x13, s14, P5/1 Pro M2123,	
Premium Server SE 4/33			RS/6000 POWERstation/POWER Server 220 series	
4MB w/WP1	5007780-0011	5354	4MB 6450120	5410

IBM PS/Velocipoint	SMB	6450130	\$625	\$410
Compaq Prolinea 433	SMB	141683-001	\$499	\$410
AST Bravo 4/33	SMB	300780-001	\$469	\$384

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Prolinea 3/25, 3/25c

IBM PS/2 386, 486, 586, 686

IBM Continued

PS/2 80-111; 311; 121; 321; 686; 161

[illegible]

40MB 11640-001	S195	2MB	112877-001	S410	Ready 425,433
ProSystem PC Server 486/33, DX2/66				4MB N/A	S195 16MB N/A
16MB 149320-001	S694	32MB	149147-001	S2002	PowerMate 386/33 Express To 5 series
SystemPro III (486/50)	5429	32MB	134817-001	S1497	4MB OP-410-420S
16MB 134818-001	S7002	128MB	139911-001	S8009	PowerMate 286/12.5/14.5/20
4MB N/A	S7002	128MB	139911-001	S8009	2MB Kit
DeskPro 386/33 486/33, SystemPro, SystemPro S series					OP-410-8103
2MB 115144-001	S92	2MB	116451-001	S369	PowerMate 386S/20; 20v; 14c 25c 486/50 486/33
DeskPro 386/33, 486/33, SystemPro II, System Pro S series					8MB Kit
2 64MB Board w/2MB					OP-410-2101
DeskPro 386/33, 486/33, SystemPro					PowerMate SX Plus
6 Socket Brd w/2MB	116549 + 115144-001				2MB
					4MB
					N/A
					N/A
					PowerMate SX/20
					20MB (2) Upgrade
					OP-410-8101

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NAME	310 3133	5500	3280	310 3337	51001		ME 432	519
Howlett-Packard								
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
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4MB K							ME 402	519
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4MB K							ME 402	519
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4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K							ME 402	519
Vecro QS/145, 20PC, K5/20, D1C 25, 25K							ME 402	519
4MB K								

Vectra 350/330/330i	4M8	ZA4200M2	\$199
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IBM PS/Valuepoint	3MB	6450130	\$623	\$410
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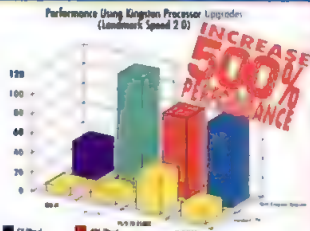
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ADI

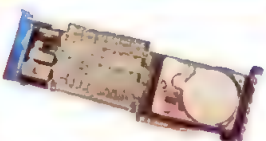


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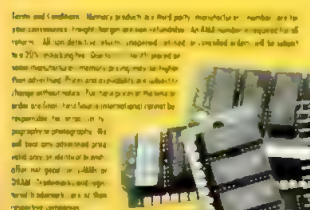
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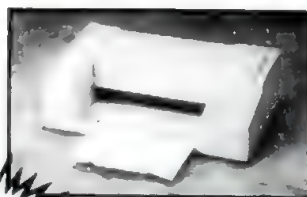
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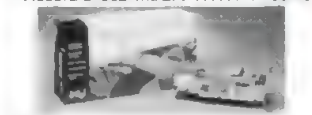
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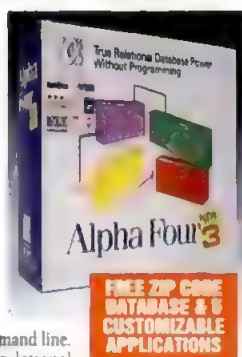
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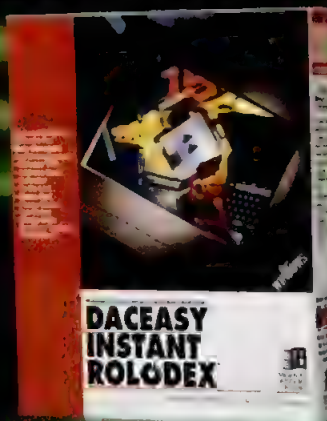
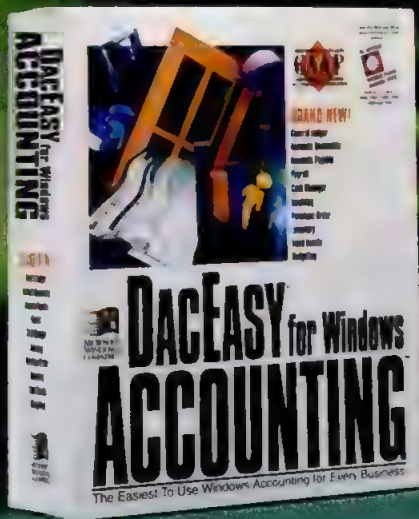
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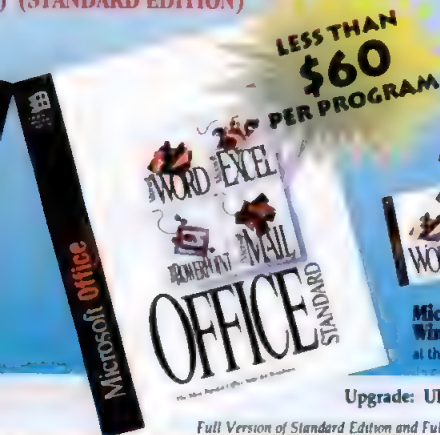
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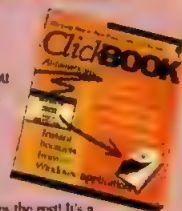
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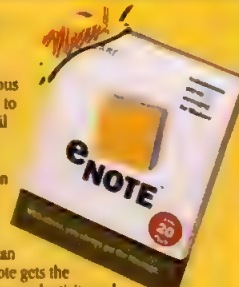


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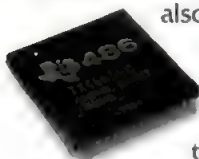
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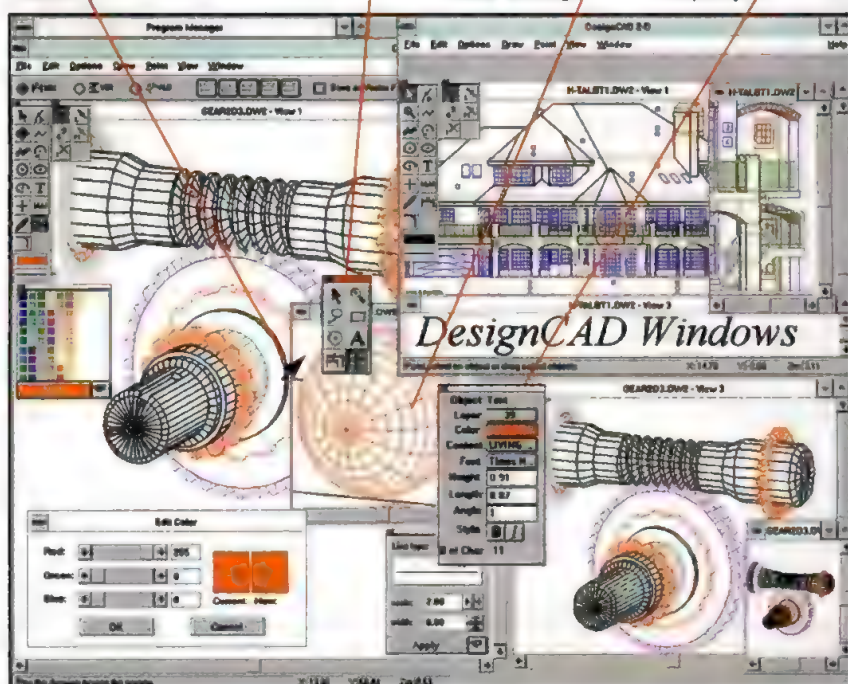
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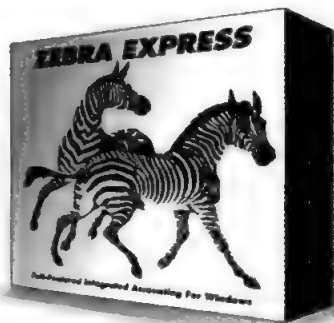
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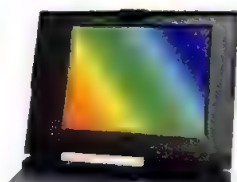


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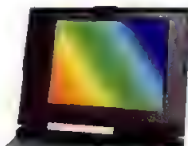
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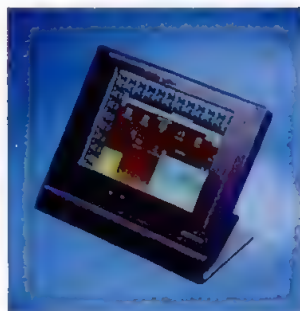
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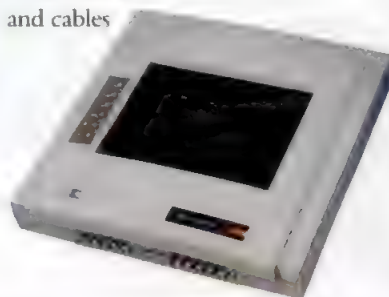
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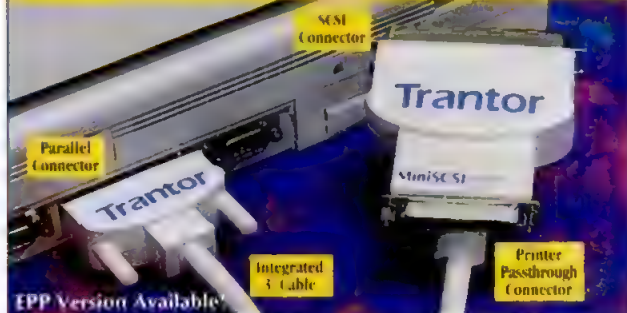
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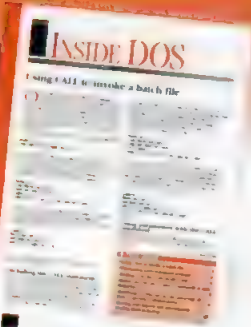
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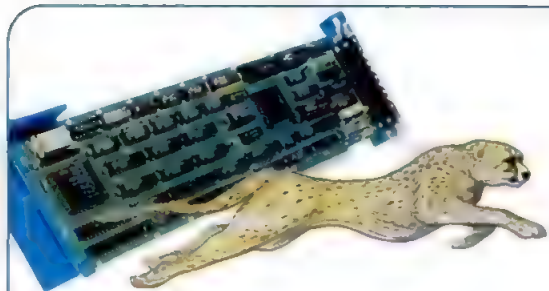


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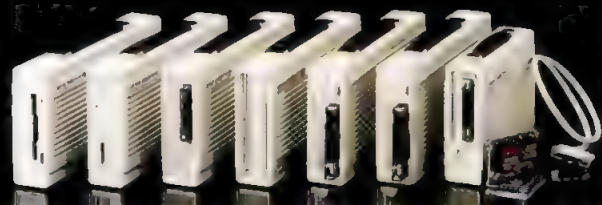
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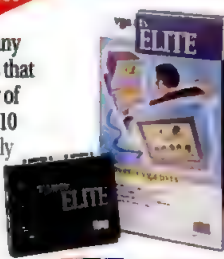
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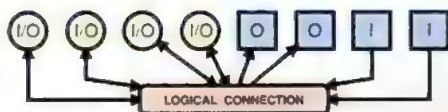
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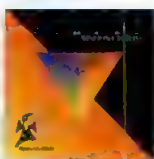
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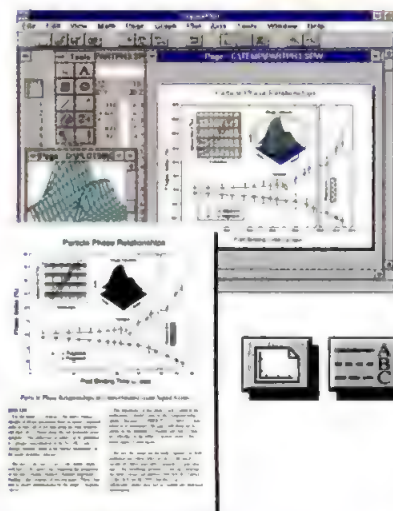
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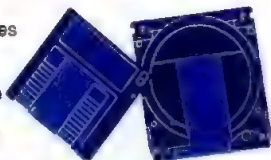
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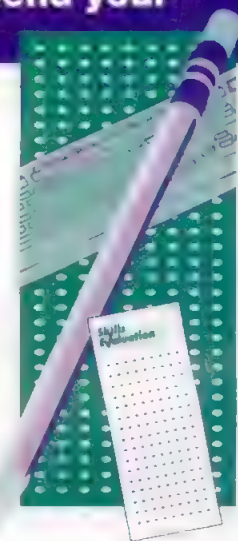
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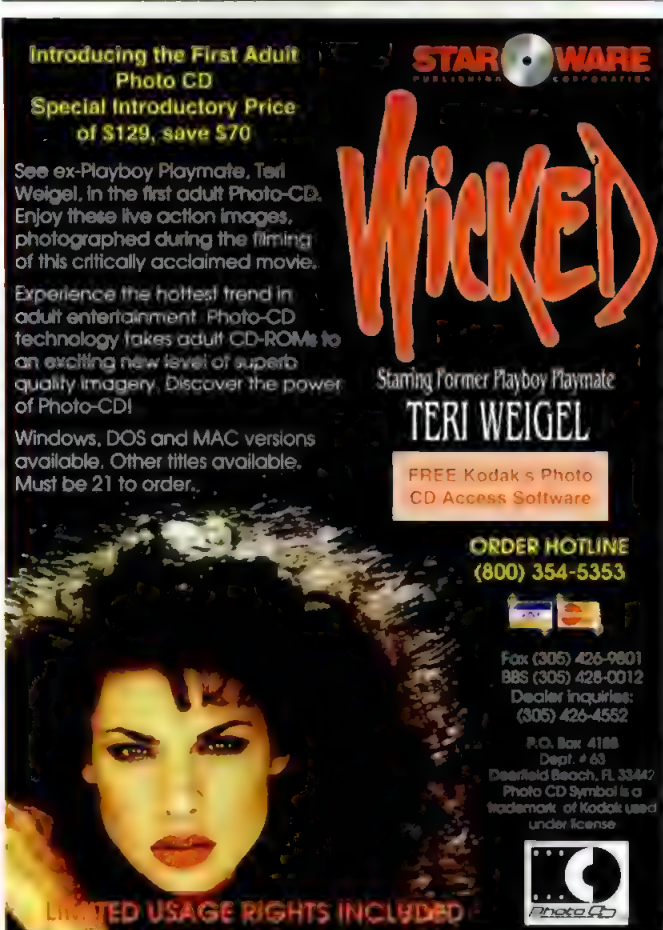


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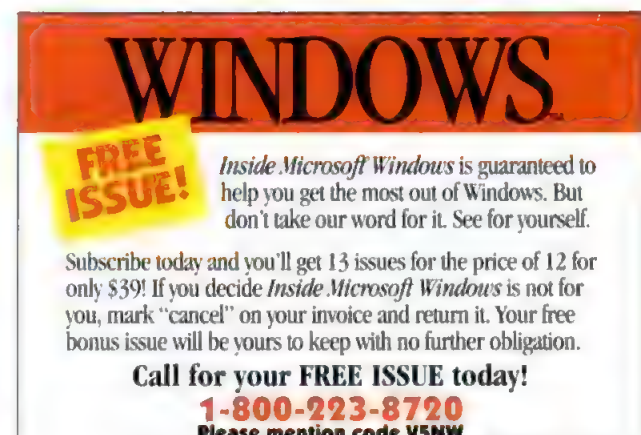
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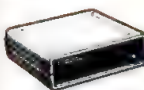
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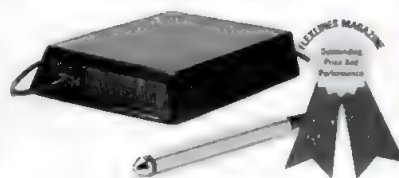
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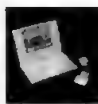
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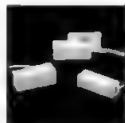
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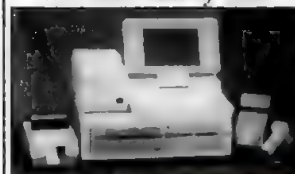
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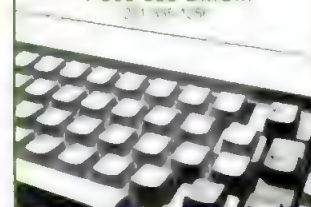
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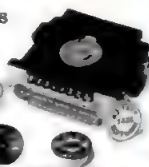
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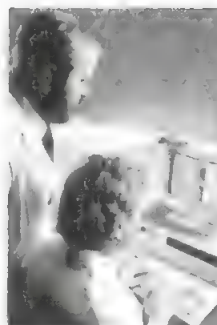
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4. Is your company a reseller?
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6. Are there any PCs in your office?

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7. Please check the equipment currently installed at your location: (Check all that apply)

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06. ☐ Windows

8. Do you plan to buy any PC products?

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02. ☐ In 4 to 6 months 04. ☐ No definite plans

9. Number of employees in your entire company:

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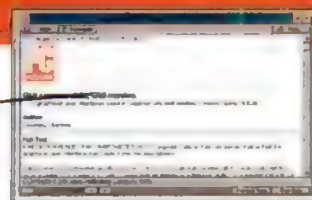
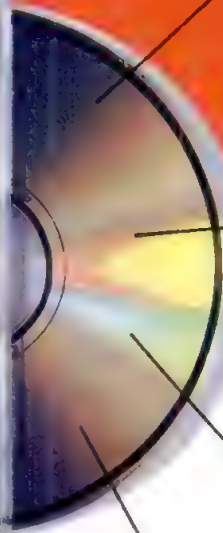
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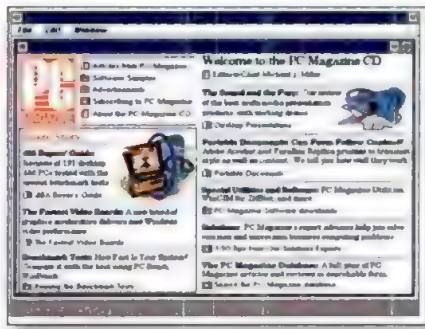
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Coming Up

The 10th Annual Awards for Technical Excellence

Continuing a decade of tradition, *PC Magazine* honors 1993's outstanding breakthroughs in hardware and software—and the people who made them happen—with the industry's most coveted prize.

Color Portables

As screen technologies continue to break new price/performance ground, more traveling notebook users will be able to afford color systems. Once a luxury reserved for the computing elite, color is going mainstream. *PC Magazine* checks out 33 of today's newest and most colorful notebooks to determine which are on the cutting edge.

Power and Promise

What was once a buzzword is quickly becoming a checklist item for today's notebook buyers: PCMCIA. Portable PCs designed to use these credit card-size memory, storage, and communication devices promise desktop functionality on the road. *PC Magazine* evaluates 35 of the newest PCMCIA cards to see if they fulfill this potential.

PCMCIA Adapters

Like your notebook computer, your notebook PC LAN adapter should be light, portable, and easy to use. PCMCIA adapter cards fill the bill. *PC Magazine* and ZD Labs test 15 Ethernet and 4 Token-Ring PCMCIA LAN adapters for performance, compatibility, and ease of use. Our test results just might surprise you.

Free Utility

DOS isn't very smart when it comes to beating a PATH to your applications' door. Where DOS will search all of the directories on your search PATH, next month's utility, QPATH, tells DOS to look first in the directory of your choice. QPATH also lets you tell DOS to ignore commands so that the uninitiated—or the malicious—can't do harm to your system.

Extending Your Apps

In the next issue, we introduce Extending Your Apps. Let our experts show you how to extend the power of your applications and make them work better with other applications.

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Reader Service

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HOLIDAY GIFT GUIDE

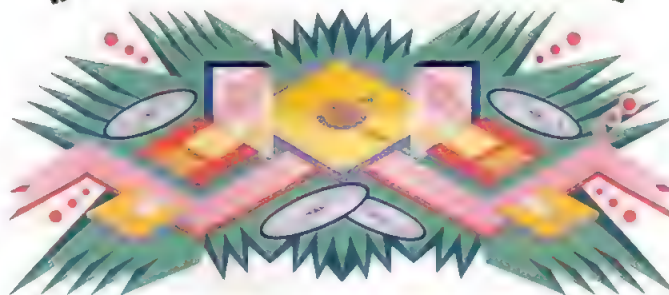
BY DONALD B. TRIVETTE
AND JULIE COHEN

It's that time of year again: time to hit the stores to find the perfect holiday gift. But where to begin? What size? What color? This year, we ease your burden with reviews of 50 of the best and brightest products of the year.

Here are more than a dozen games, from mind-bending fantasy, adventure, and strategy games to action-packed sports simulations and arcade favorites. To broaden your knowledge, we've looked at 12 reference products and four do-it-yourself guides.

Kids' software suits all ages—from the enormously entertaining *KidCad* (where kids can construct and destroy their own 3-D buildings) to Richard Scarry's *Busytown*, for the youngest PC users.

Finally, give your computer a holiday season facelift with any of the eight screen savers and wallpaper makers we've reviewed.



50 Ways to Celebrate the Season

Puzzles to Pinball: Games for All

Whether your loved ones prefer fast action or mind-benders, there's a game for them this season. Here are six entertaining choices, from pinball to poker.

A simulation of Bally's classic pinball game with a pool-table landscape, **Eight Ball Deluxe** (DOS, \$34.95) puts a

new spin on both games. The physics and formulas to carry this off are considerable, because the ball's rebound and action look absolutely authentic. This is the best pinball game around, with stereo sound and VGA graphics. (*Broderbund Software*, 800-521-6263.)

Circle 516 on reader service card.

Street Ball (DOS, \$14.95)

brings Pong to the '90s. A ball whizzes along a horizontal or vertical wire; at exactly the right moment, you dislodge the ball so that it hits targets in a maze. With the correct angle, the ball may ricochet and capture several targets.

This is a cheap and challenging stocking stuffer. (*Frogman Software*, 800-759-2562.)

Circle 517 on reader service card.

The Beavis and Butthead generation will love **Whac-A-Mole** (Windows, \$39.95). The name says it all: whack the little critters as they pop out of the ground. Fast and accurate whacking with your mouse-controlled mallet lands you on a more difficult molehill. An entertaining, if somewhat off-beat, choice. (*Swfte International*, 800-237-9383.)

Circle 518 on reader service card.

When you tire of whacking the screen, here's something to whack your brain. **CrossWire!** (Windows, \$39.95) is as addictive as "Jeopardy." Match words that belong together: say, Colt and Revolver, Otis and El-

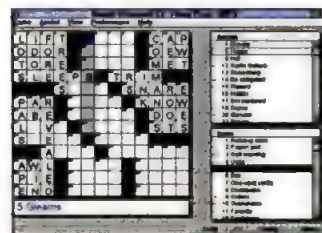
evator. There are 16 categories and six challengers with different strengths and personalities. (*SilverSun*, 800-874-5837.)

Circle 519 on reader service card.

More brain food: **Lyriq Crosswords** (Windows, \$39.95) is all a word lover could want, with more than 250 puzzles from The Washington Post, Penny Press, and Crossword Magazine. The mouse interface couldn't be better, and the game provides ample challenges for kids, novices, and the truly addicted. (*Lyriq International*, 800-433-4464.)

Circle 520 on reader service card.

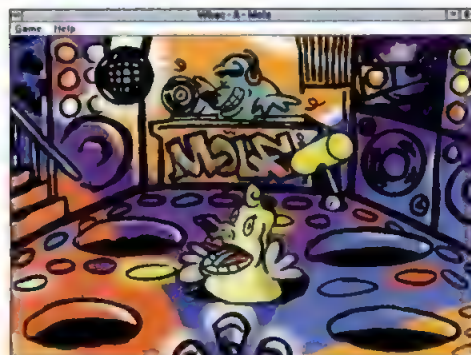
Bicycle Limited Edition (Windows, \$49.95) contains dozens of variations on solitaire, poker,



FOR THE CROSSWORD ADDICT: Lyriq features 250 puzzles.

cribbage, and bridge. Great graphics make this a card-player's delight. (*Swfte International*, 800-237-9383.)

Circle 521 on reader service card.



GET THAT RODENT! Whack the moles as they pop up on the screen.

The Home Reference Library

How far is Saskatchewan from Des Moines? Who said "Love means never having to say your sorry?" What would you weigh on Jupiter? Look-it-up reference materials are showing up everywhere on your PC. Here's a guide to the season's must-haves.

PC Globe Maps 'N Facts (DOS, \$34.95) is part world atlas and part almanac. The atlas has both political and physical country maps, though it lacks provinces, climates, and roads, features commonly found in paper versions. There's a wealth of supplemental information, such as

Continues

Real Ordinary



ReelMagic



There's more to games than a mouth that sort of moves or tinny sound. Now there's a new way to play PC games that's just like sitting in a theater controlling the action with your joystick.

It's ReelMagic™, the new MPEG playback adapter. Available only from Sigma Designs. This incredible add-in board brings the next generation of CD-ROM

ReelMagic™

games to your PC bigger than life.

Say adios to wimpy graphics. Herky-jerky movement. Bogus sound.

And phony scenarios. ReelMagic pumps up the reality meter so you can crank up the fantasy.

We've also included Activision's *Return to Zork* so you can experience the excitement of full motion video now.

It's not real unless it's ReelMagic. Call 1-800-845-8086 ext. 320 for a dealer demo near you. Or you can stick with real ordinary. Oh joy!

Only ReelMagic Makes It Real.™

SIGMA DESIGNS®

CIRCLE 399 ON READER SERVICE CARD

Discover the new generation of ReelMagic games from these manufacturers, and look for more exciting titles coming soon.

ACTIVISION

SIERRA®

trilobyte

Interplay
ACCESS
SOFTWARE INCORPORATED

Virgin
GAMES

COMPTON'S
NEW MEDIA

READYSOFT

aris
entertainment

© 1993 Sigma Designs, Inc. The Sigma Designs logo is a registered trademark and ReelMagic is a trademark of Sigma Designs, Inc. All other brand names and products are trademarks or registered trademarks of their respective holders.

256 VS. 32,768 COLORS Why settle for a mere 256 colors, offered by current PC games, when ReelMagic gives you theater-quality graphics with over 32,000?

GRUNTS VS. CD-QUALITY AUDIO Get 16-bit CD-quality sound that plays Sound Blaster™ and Windows™ compatible software. The 8-bit audio you're used to just doesn't compare.

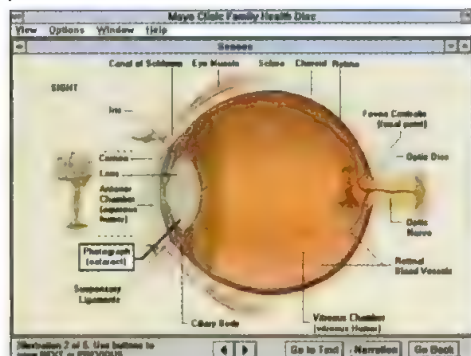
9 FPS VS. 30 FPS ReelMagic-compatible games run at 30 frames-per-second, TRUE full-motion, so you avoid jerky, blocky images.

1/4 VS. FULL SCREEN Now you can get theater-quality video in a full-screen image for a realistic, movie-like experience.



Reference

industry and recreation, and you can annotate and print maps. For users without multimedia hardware, this product is an outstanding buy. (*Broderbund Software*, 800-521-6263.)



EYE ON HEALTH: Mayo Clinic Family Health Book provides top-notch reference material.

Circle 522 on reader service card.

For a complete family health-care reference, you can do no better than the **Mayo Clinic Family Health Book** (CD-

ROM, \$69.95), a multimedia edition of the 1,300-page home medical reference. Topics are covered in detailed sections with 500 illustrations—and 90 minutes of audio. Browsing and searching are intuitive and the text is full of hyperlinked words.

(*Sony Electronic Publishing*, 408-372-2812.)

Circle 523 on reader service card.

For news hounds, there's **CNN Newsroom Global View** (DOS, \$99.95) and **Time Almanac** (CD-ROM, \$149.95). CNN Newsroom contains selected articles covering

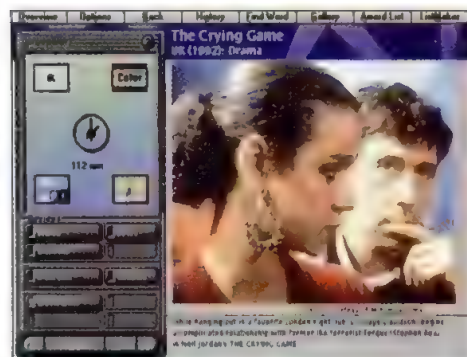
six topics: Small World, Waging Peace, Collapse of Communism, African Politics and Poverty, Cultures in Conflict, and Earth Matters. Time Almanac has full-

color maps plus a full-text collection of the articles and photographs in *Time Magazine* since 1989, with some articles from earlier issues. Finally, you can throw out your stack of Time Magazines without guilt. (*Compact Publishing*, 800-964-1518.

Circle 524 on reader service card.

THE BIG SCREEN

Cinemania 1994 (CD-ROM, \$79.95) is the ultimate movie buff's guide to the cinema. Capsule descriptions of 20,000 films, along with 800 detailed reviews of important motion pictures, make this the most complete CD-ROM movie guide available. Culled from the works of



THE SECRET'S OUT: Cinemania 1994 details more than 20,000 films.

Leonard Maltin, Pauline Kael, and Roger Ebert, Cinemania covers popular video releases as well as classics and foreign films.



New this year are full-motion video clips, sound track music, and more thorough reviews. (*Microsoft Corp.*, 800-426-9400.)

Circle 525 on reader service card

An inexpensive alternative, **Video Movie Guide** (CD-

Continues

THE SPORTING LIFE

Michael Jordan In Flight (DOS, \$59.95) is easily the most realistic arcade game around. This is three-on-three, half-court basketball at the street, college, or professional level. As the fabled Michael Jordan, you fly around the court making hoops no other could hope to make.

Jordan In Flight looks and sounds like TV: The camera tilts, pans, and zooms to follow the 3-D action around the court and you clearly hear Jordan's digitized voice—encouraging or taunting—over the thumping of leather on wood. No stick figures these guys, but rather solid athletes with moves based on actual videotape of the

players. To do it justice, In Flight needs a fast computer, a Super VGA monitor, and a sound card, but for a basketball fan it's worth the price. (*Electronic Arts*, 800-245-4525.)

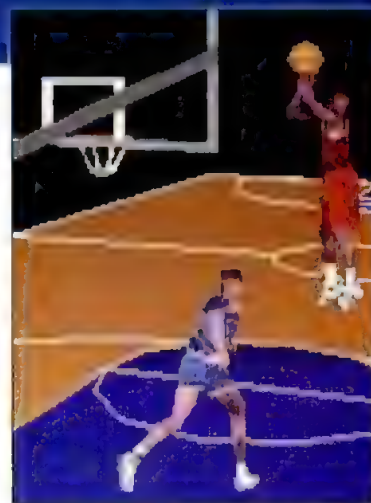
Circle 527 on reader service card.

If racing is your sport, try **World Circuit: The Grand Prix Race Simulation** (DOS, \$49.95), with its 16 courses and the specialized cars that race there. Getting started in record time, with almost no learning curve; just grab the joystick (or cursor keys) and burn rubber. For serious enthusiasts, advanced levels require practiced driving skills and a mastery of details. The 3-D graphics and animation are smooth on a fast computer,

and the animation frame rate can be lowered and surface textures removed to improve performance on slower machines. (*MicroProse Software.*, 800-879-7529.)

Circle 528 on reader service card.

For the baseball fan, **Hardball III** (DOS, \$59.95) is baseball at its finest, played in eight accurately rendered Major League stadiums. The heart of this game is league play, in a full 162-game series that culminates in the World Series. The 3-D players have remarkable control: From the mound you can deliver eight different pitches, from a crazy screwball to a sweet



SWOOSH! Michael Jordan In Flight slam dunks the competition.

curve; from the plate you can swing, power swing, or bunt. The play-by-play commentary of ABC Sports' Al Michaels adds realism. (*Accolade Inc.*, 800-245-7744.)

Circle 529 on reader service card.

Reference

ROM, \$39.95) is based on the book by Mick Martin and Marsha Porter, and features brief reviews of 12,800 new and old films that can be rented in video stores. (*Advanced Multimedia Systems*, 800-626-4105.)

Circle 526 on reader service card.

For video fans and film buffs without a CD-ROM drive, **Banner Blue Movie Guide** (DOS, \$44.99) is a super-fast index to more than 10,000 movies available on videotape. Each movie is summarized in one or two sentences. The hyperlinked index helps you search the database quickly and effortlessly. (*Banner*

Blue Software, 510-794-6850)

Circle 530 on reader service card.

LOOKING FORWARD AND BACKWARD

What better time than a clear winter night to turn eyes to the heavens and marvel at the wonders of the stars? Part planetarium and part encyclopedia, **Discover Space** (DOS, \$39.95) brings the sky to life. Simulate solar and lunar eclipses; print star maps keyed to your own neighborhood; study space exploration programs,

and uncover the myths and facts surrounding constellations like the Big Dipper and Pegasus. Beautifully rendered VGA and Super VGA images and detailed text make this a great gift for budding astronomers. (*Broderbund Software Inc.*, 800-521-6263.)

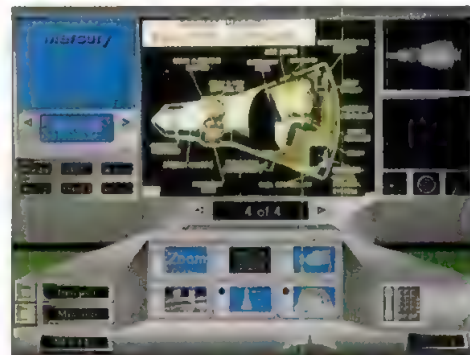
Circle 531 on reader service card.

Americans in Space (CD-ROM, \$69.95) is an exhaustive reference of NASA missions and the American space program. You'll find details on every manned American space mission as well as 500 stunning photographs of outer space. An hour of full-motion video and narration brings the space program to life. Cruise the planets,

learn about living in space, and navigate through historical data about each mission. (*Multicom Publishing Inc.*, 206-622-5530.)

Circle 532 on reader service card.

Three dinosaur programs are



SPACED OUT: *Americans in Space* gives you a glimpse of every NASA mission.

stalking the shelves this season. **Dinosaurs: The Multimedia Encyclopedia** (CD-ROM, \$79.00) is the most complete, with everything you wanted to know about these Jurassic beasts, including narrated presentations and video answers to some of kids' favorite questions. Microsoft **Dinosaurs** (CD-ROM, \$79.95)

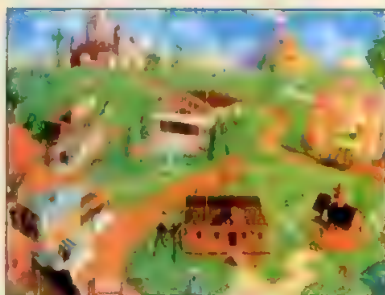
features beautifully rendered illustrations and lots of hyperlinked text. Finally, Knowledge Adventure's **Dinosaur Adventure** (DOS, \$49.95) provides kids with full-motion video, stories, and games in a program that still fits on your hard disk. (*Sony Electronic Publishing*, 310-449-2392.)

Circle 533 on reader service card.

ON LINE CONNECTION

As you plan your Christmas shopping, don't overlook the on-line services and networks: gifts that keep you well-connected throughout the year.

The ImagiNation Network, formerly known as The Sierra Network (TSN), is an all-entertainment environment with a graphical interface that makes you feel like you're playing locally, while you chat and play with subscribers all over the country. In ImagiNation, you create your own persona—male or female, blond or brunette; the service



ON-LINE FUN: *ImagiNation Network* hooks you up with games nationwide.

has become a unique hotspot for virtual dating. If games interest you more than conversation, NTN Trivia (a popular timed game played in bars and night clubs), 3-D Golf (similar to the popular Links 386 Pro), Euchre (a bridge-like card game), and Milton-Bradley's famous Stratego, are other newcomers. ImagiNation is the place to be for fun and games. (*ImagiNation Network*, 800-462-4461.)

Circle 534 on reader service card.

If you're looking for more than fun and games, three popular choices are America Online, CompuServe, and Prodigy. **America Online** (800-227-6364) has the easiest interface and the most popular and diverse chat rooms in the business; if making friends and chatting on-line appeals to you, this is where you belong. For the largest selection and biggest international user base,

CompuServe (800-848-8990) is one of the most complete networks around, and with its own menu-driven graphics software, the service is now easier to use than ever.

Prodigy (800-776-3449), meanwhile, is the *USA Today* of networks: bright, colorful, and full of advertising that helps keep the price affordable. Like its sister services, Prodigy has entertainment, education, reference, and business sections, plus gateways to the ImagiNation Network and the Internet.

For Kids Only

For the creative—and the destructive—impulses in all of us, **KidCad** (Windows, \$49.95) lets kids age 7 and up build, furnish, populate, and bulldoze their own 3-D houses. Choose your city, country, or town as the backdrop, then use the pro-

gram's library of three-dimensional building blocks, windows, doors and stairs to make your creation. Decorate the rooms; add people, trees, dinosaurs. Want to start again? Choose a swarm of bees, a bulldozer, or a light saber to demol-

Continues

ish your creation. (*Davidson and Associates, 800-545-7677.*)

Circle 535 on reader service card.

What kid doesn't love the Peanuts gang? With **Yearn 2 Learn** (DOS, \$64.95), Snoopy, Woodstock, and their friends teach 3- to 10-year-olds math, geography, and basic coordination and observation skills. Five multi-level activities will challenge your child. Math and geography exercises stress memorization, as Woodstock adds and subtracts his friends, Linus weighs pumpkins in the pumpkin patch, and Snoopy presides over a U.S. map puzzle. Comics, coloring, and a game starring the World War I flying ace round out the fun. (*Image Smith, 800-876-6679.*)

Circle 536 on reader service card.

Broderbund scored a major hit this year with its Living Books series. **Just Grandma and Me** is perfect for younger children and **Arthur's Teacher Trouble** (CD-ROM, \$59.95 each) for elementary-schoolers. These electronic books add sound and animation favorite children's stories, and hot spots that make characters and objects respond will keep kids amused long after they've read the words. (*Broderbund Software, 800-521-6263.*)

Circle 537 on reader service card.

Sierra On-Line, brings the electronic children's book concept to the hard disk. **Slater and**



THE GREATEST PUMPKIN: Yearn 2 Learn's math exercises get progressively more challenging.

FUN AND FRIVOLITY

Some products simply defy classification. Here are two whose main purpose is simply to make you smile.

Funny: The Movie for Windows (Win-

dows, \$39.99) may be the most innovative multimedia product of the year. *Funny*, a 1988 motion picture produced by Bran Ferren, is a series of video clips of 84 people telling jokes and funny stories; some are famous entertainers Dick Cavett, but most are ordinary folks. *Funny*, the CD-ROM, categorizes the jokes into groups so you can easily focus on a particular subject. Or you can watch all 88 minutes in sequential order. (*Warner New Media, 818-955-9999.*)

Circle 540 on reader service card

Charlie Go Camping (DOS, \$49.95), is the tale of a blue dinosaur and his companion on their camping adventure. Not quite as richly animated as the Living Books, the story still has lots of hot spots for younger children. (*Sierra On-Line, 800-326-6654.*)

Circle 538 on reader service card

The youngest kids will love **Richard Scarry's Busytown**. Paramount Interactive took the word "busy" seriously. There are a dozen activities designed to teach numerical, language, and problem solving skills. Perfect for teaching basic skills in an encouraging, entertaining environment. (*Paramount Interactive, 415-812-8200.*)

Circle 539 on reader service card.



LOTS OF LAUGHS: *Funny's* videos will keep you smiling.

PC Karaoke (CD-ROM, \$99) is an award-winning sing-along program like the one found in bars and nightclubs. The program plays CD audio with the same clarity and

quality as your home stereo system. As the music plays, lyrics appear on the screen in large type, with words changing color to mark your place. The start-up package has a microphone and a CD-ROM with ten songs, including "Pretty Woman," "Unforgettable," and "Twist and Shout," but plan on

buying several more CD-ROMs at a cost of \$20 each. There are even four new holiday disks in the collection. (*Sirius Publishing Inc., 800-247-0307.*)

Circle 541 on reader service card.

Dress Up Your Screen

Screen savers are hot. Originally created to keep the monitor from displaying the same image too long, these products now take personal tastes into account.

A holiday must, **Simple Simon Says Christmas For Windows** (Windows, \$14.99) makes any computer festive. With its selection of thematic wallpaper, screen savers, games, an icon designer, and a greeting card maker, this is the package for the season. There are even two TrueType Christmas fonts. (*TDA Help! 206-742-4145.*)

Circle 542 on reader service card.

With more than 40 stunning photographs of the great outdoors, **Microsoft Scenes: Sierra Club Collection** (Windows, \$29.95) gives you great variety,

plus the ability to add your own pictures. All shots are usable as screen savers or as Windows wallpaper. Two other editions are available: the Impressionists Collection, and the Outer Space Collection. (*Microsoft Corp., 800-426-9400.*)

Circle 543 on reader service card.

If its realism you want, **ArtScreens** (Windows, \$49.95) offers extraordinary renditions of the masters. (*Trident Software, 703-761-6165.*)

Circle 544 on reader service card.

New from the best-known screen saver people, Berkeley Systems, are **The Disney Screen Saver Collection** (Windows, \$49.95) and **After Dark for DOS** (DOS, \$49.95). The Disney collection features wonderful ani-

Continues

Screen Savers

mations of Mickey, Donald, Goofy, and friends: a crocodile chases Captain Hook, Donald paints the screen, and Uncle Scrooge goes after greenbacks; it has superb animation and clever antics. After Dark for DOS ports the flying toasters to the world of DOS. (Berkeley Systems, 510-540-5535.)

Circle 545 on reader service card.

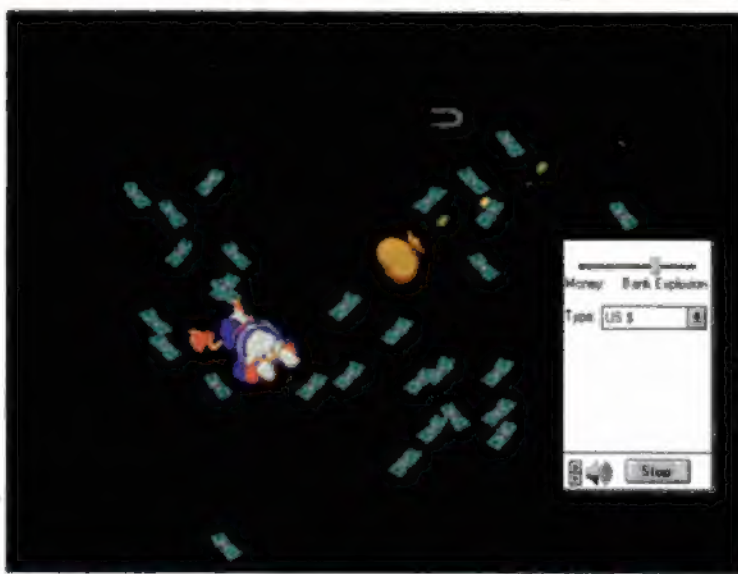
Phantom Screen (DOS, \$25) includes animated fish, fireworks, aircraft, and dinosaurs, or you can use your own PCX images. If you

want even more options for your DOS environment, try **Quick Menu III** (DOS, \$89.95), a customizable desktop menu system for DOS-based computers with extras like security, networking, calendar, and phone book. You

can even launch Windows applications. (OSCS Software Development, 800-545-1392.)

Circle 546 on reader service card

Lights Out Sports Fans (Windows, \$55) has licensed major-league baseball team logos for its Windows screen saver. This one's for serious sports fans,



SAVE A BUCK...or just your screen, with the Disney Screen Saver.

since it doesn't do much, but the logos are authentic. The most interesting feature: a simulated baseball game between teams of your choice. (Quadrangle Software, 800-253-8397.)

Circle 547 on reader service card.

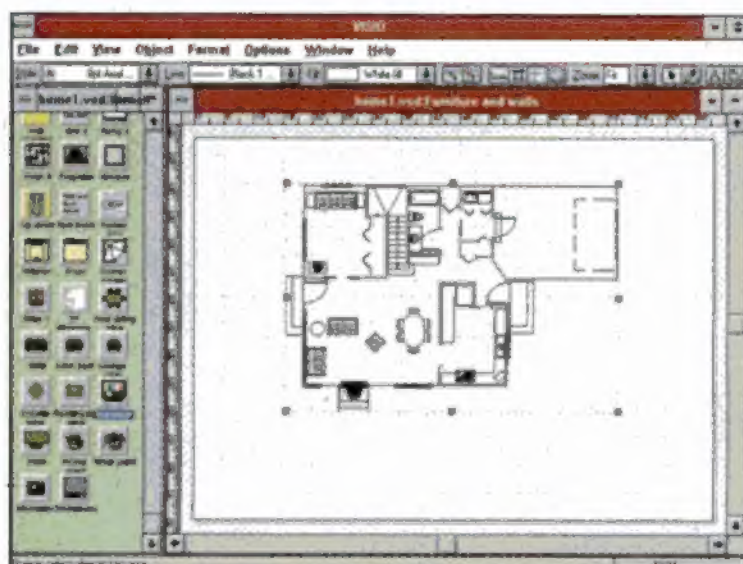
Do It Yourself

Here are four do-it-yourself programs that give you guidance on anything from your carburetor to your shrubbery.

Autoworks (DOS, \$69.95) shows you the internal workings of your car, with text and hun-

dreds of high-quality color illustrations and eight attractive animated diagrams. This is the best way to learn about your car without getting grease under your fingernails. (Software Marketing, 602-893-3377.)

Circle 548 on reader service card.



SMART FURNITURE: Visio Home's furniture sizes itself more easily than many CAD packages.

Land Designer (DOS, \$89) can get you ready for the spring thaw. This program takes you from landscaping plan to planting list in short order, and keeps you within budget too. Fine for small jobs and do-it-yourself landscapers,

there's an extensive library of 300 trees, plants, and yard furniture. Also available are optional plant libraries keyed to the growing zones across the country. A comprehensive sprinkler layout system helps check coverage and helps avoid costly plumbing errors. (Green Thumb Software, 800-336-3127.)

Circle 549 on reader service card.

A remarkably logical twist in home-design software, **Visio Home** (Windows, \$79) uses drag-and-drop symbols that automatically size themselves instead of conventional CAD methods. Position a shape and

then stretch it to the proper size. The large library includes smart shapes for everything from walls to furniture, and from shrubbery to swimming pools. (Spaceware Corp., 206-467-6723.)

Circle 550 on reader service card.

Family Tree Maker (DOS, \$59.99) is a fast way to organize all those third cousins that litter the branches of everyone's family tree. Fill in the index cards that appear on the screen; the program prints ancestor and descendant trees with up to 2,400 people in one card file. (Banner Blue Software, 510-794-6850.)

Circle 435 on reader service card.

Fantasy Fun

From the farm to the future, these five games will take you to another plane.

SimFarm (DOS, \$49.95) is the country cousin of the best-selling SimCity. Test your agrarian skills by growing crops and raising livestock; use your management skills to stay solvent. This realistic sim includes pests, weeds, floods, and bankers. (Maxis, 800-336-2947.)

Circle 436 on reader service card.)

Return of the Phantom (CD-ROM, \$59.95) is set in turn-of-the-century Paris as the Red Death returns to terrorize the Opera House. You are Inspector Montand, who looks for clues in the labyrinth. Good production value and excellent music on this CD-ROM make it a treat for lovers of Gothic mysteries. (MicroProse, 800-879-7529.)

Circle 437 on reader service card.)

Ultima VII, Part II: Serpent Isle (DOS, \$79.95) is a continuation of The Black Gate. Was the Guardian really defeated? Where is Batlin? Explore the newly discovered Britannia, then venture deep into the Swamp of Gorlab and scale the Spinebreaker Mountains. Ulti-

ma fans will find familiar people and places, but prior experience is not necessary. Enhanced sound and speed make this the best Ultima yet. (Origin Systems, 800-245-4525.)

Circle 438 on reader service card.

High Command: Europe 1939-1945 (DOS, \$69.95) is your chance to fight World War II again. Execute blitzkriegs, airborne assaults, and amphibious landings across Europe; control diplomatic negotiations and



foreign aid. A board game in the tradition of Stratego in Super VGA graphics. (Three-Sixty Pacific, 800-653-1360.)

Circle 439 on reader service card.

King's Quest VI: Heir Today Gone Tomorrow (\$79.95) is now available on CD-ROM, with four hours of continuous dialog and narration. As Prince Alexander, you go in search of your true love, the Princess Cassima, who is being held prisoner in a dank castle. Darker and more ominous than previous quests, King's Quest VI is a leading-edge game with outstanding graphics. (Sierra Online, 800-326-6654.)

Circle 440 on reader service card.

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott



Call 800-CAL-DEAD to get your \$10 Grateful Dead mouse pad. A \$15 wrist rest is also available. (Grateful Dead merchandising.)

Higher Ed Goes High Tech

"The Macintosh helps students write faster and more neatly," says English Department Chair Marlene Bosanko. "Because it's designed to work like the human brain, a student can be up and running in just a few minutes."

—TACOMA COMMUNITY COLLEGE CATALOG

Hail, Edna, Full of Grace

"St. Mark's Lutheran Church bought a computer and created word processing templates for services such as weddings and funerals. . . . Recently they had to bury a Mary, followed by an Edna, and the church secretary ran the computer's usual search-and-replace function to change the names. When the pastor and those of Edna's friends who were following the worship folder got to the Apostles' Creed, they came upon a revelation. 'Born of the Virgin Edna,' it read."

—THE AGE (VICTORIA, AUSTRALIA)

Oh, Canada, Our Plus and Minus Signs

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Dig It Up and Sell It!

At the launch of the \$4,700 ThinkPad 750C, IBM VP Micheal Coleman admitted difficulties in meeting demand for the notebook. Then he said, "Students at Clemson University were so impressed with the ThinkPad that they wanted to get one to bury in a time capsule."

If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802. Winners this issue: Mark Barry, Carlos Branche, Rob McCrae, Glen Murray, and John W. Sims.



Richard Tennant

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